NORDISK HYGIENISK TIDSKRIFT
Supplementum 1

On the Possibilities of Changing the Annoyance Reaction to Noice by Changing the Attitudes to the Source of Annoyance

By

STEFAN SÖRENSEN

STOCKHOLM 1970

Digitized by the Internet Archive
in 2026

https://archive.org/details/IA41552722_0008

Nordisk Hygienisk Tidskrift
Supplementum 1

From the Department of Environmental Hygiene, Karolinska Institutet
and the Department of Environmental Hygiene,
National Institute of Public Health
and the Department of Sociology, Stockholm University,
Stockholm, Sweden.

ON THE POSSIBILITIES OF CHANGING THE ANNOYANCE REACTION TO NOISE BY CHANGING THE ATTITUDES TO THE SOURCE OF ANNOYANCE

by

STEFAN SÖRENSEN

STOCKHOLM 1970

UNIV.
LEIDEN
BIBL.

Tryckeri Balder AB, Stockholm 1970

On the possibilities of changing the annoyance reaction to noise by changing the attitudes to the source of annoyance

AKADEMISK AVHANDLING

som med tillstånd av samhällsvetenskapliga fakulteten vid
Stockholms Universitet för vinnande av filosofisk doktorsgrad
framställes till offentlig granskning
på lärosal F, Norrtullsgatan 2,
fredagen den 15 maj 1970 kl. 10.

av

STEFAN SÖRENSEN
fil. lic.

STOCKHOLM 1970

CONTENTS

CHAPTER 1: Attitudes in Annoyance Reaction 5

CHAPTER 2: Annoyance reactions 8
2.1. Structure of the annoyance reaction 9
2.2. Earlier studies of annoyance 10

CHAPTER 3: Changes of attitude and annoyance reactions 14

3.1. Changes of attitude and annoyance reactions. Results of laboratory experiments 17
3.1.1. Arrangement and conduct of the experiments 17
3.1.2. Influence on attitude 18
3.1.3. Exposure to noise 19
3.1.4. Estimate of annoyance 20
3.1.5. Results 20
3.1.6. Comments 22

3.2. Changes of attitude and annoyance reactions. Results of field experiment 23
3.2.1. Arrangement and conduct of the experiment 23
3.2.2. Influence on attitude 24
3.2.3. Exposure to noise 25
3.2.4. Measurement of response 25
3.2.5. Results 26
3.2.6. Comments 29

3.3. Changes of attitude and annoyance reactions. Results of investigation of the constancy of the changes 31
3.3.1. Arrangement and conduct of the investigation 31
3.3.2. Exposure to noise 32
3.3.3. Measurement of response 32
3.3.4. Results 32
3.3.5. Comments 35

CHAPTER 4: Factors which affect the possibility of changing the attitude to a source of annoyance and the annoyance reactions 36

4.1. Factors which affect the possibility of change of attitude to the source of annoyance and the annoyance reactions. the noise level 39

4.1.1. Arrangement and conduct of the experiment 39
4.1.2. Influence on attitude 40
4.1.3. Exposure to noise 40
4.1.4. Measurement of response 40
4.1.5. Results 41
4.1.6. Comments 43

4.2. Factors which affect the possibility of change of attitude to the source of annoyance and the annoyance reactions. Individual attitude characteristics 44
4.2.1. Arrangement and conduct of the experiments 44
4.2.2. Influence on attitude 45
4.2.3. Exposure to noise 45
4.2.4. Measurement of response 46
4.2.5. Results 46
4.2.6. Comments 48

4.3. Factors which affect the possibility of change of attitude to the source of annoyance and the annoyance reactions. Individual characteristics of demographic character 50
4.3.1. Measurement of response 50
4.3.2. Results 50
4.3.3. Comments 54

CHAPTER 5: General Discussion 55

Summary 60

Appendix 1—4 62

Acknowledgements 73

References 74

CHAPTER 1

ATTITUDES IN ANNOYANCE REACTION

Mankind is today in an increasing extent exposed to various environmental stimuli such as air pollution, noise and water pollution. This exposure may give rise to undesirable effects from the point of view of environmental hygiene. The effects may be either clinically demonstrable diseases or experiences of discomfort. According to the WHO definition of health as a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity disease as well as discomfort imply an impaired state of health.

Studies have been made with the aim of elucidating the question as to how people exposed to different environmental factors experience the conditions. Attempts to relate individual experience to its physically measureable characteristics, however, have mostly been unsuccessful. This is probably because individual reactions are determined not only by structural factors in the stimulus but also by social factors related to the exposed individual such as norms, knowledge, attitudes and valuations. Factors of this kind, which affect the perception process, are usually called functional factors. The functional factors affect and are affected by the individual's experience of an external environmental factor and may therefore have a reinforcing or weakening effect on his reaction.

In order to study annoyance caused by external environmental factors from the scientific aspect, therefore, one must possess a knowledge of the factors associated with the annonyance reactions. Among the functional factors which may be assumed to affect the reaction the attitude structure of the individual probably occupies an exceptional position. This structure may primarily be made up of his attitude to the source of annoyance and of his general frame of reference for evaluation of the annoyance reaction. Attitude may be regarded both as a conceivable cause of a given reaction and as a reaction to an external environmental factor. This implies both that a change of the exposure conditions may affect the attitude structure and that a change of the attitude to a source of annoyance may affect the experience of the exposure. A change of the exposure situation, however, need not necessarily result in a change of attitude. Change of attitude is less probable, for example, when the attitude forms part of a balanced system of attitudes or if it is common to a social group that the individual belongs to. In the

same way a change of attitude need not necessarily imply a change in the individual's experience of a stimulus. The significance of attitude for the experience is probably greater in the case of exposure to weak environmental stimuli than to strong, since the effect of the functional factors on the perception is determined by the ambiguity of the structural factors (Carlsson 1954).

It is difficult to isolate all the various structural and functional factors which affect the experience of the external environment because of the probably very large number of causative factors and the mutual relations between them. This implies that annoyance reactions may arise as a result of combinations of causative factors, of which, however, the attitude to the source of annoyance seems to be of great importance.

In the present study an examination will be made of the effect of attitude to the annoyance reaction, paying special attention to the possibility of changing the annoyance reaction through a change of attitudes. The point of departure is the conditioning effect which the attitude, or factors which may be assumed to be related to the attitude, may have on the experience of annoyance.

In the first chapter the problem will be illustrated in the light of the results of a number of earlier studies made both in Sweden and abroad concerning the annoyance effect of external environmental factors. The problem of what constitutes different annoyance reactions and how they are related to the particular attitude structure will also be discussed in this context.

The following chapter will deal with the possibilities of changing the annoyance reactions by changing the attitudes, assuming that a negative attitude to the source of annoyance is related to a high frequency of annoyed persons while a positive attitude to the source is related to a low frequency. This will first be studied in a laboratory experiment in which positive and negative attitudes to a source of annoyance are created in different groups, whereafter the subject's annoyance reactions are measured. Further, a field experiment will be described in which a group of subjects after having received positive information concerning an adjacent source of annoyance is measured in regard to annoyance reactions and compared with a control material. A study will also be made of the constancy in the changes of reaction by following up the result of the field experiment at a later point of time.

In order to penetrate the problem regarding under which conditions attitude may have an effect on the annoyance reaction, some experimental

studies will be reported in the subsequent chapter. These studies deal with the possible effect which certain stimulus characteristics as well as attitude characteristics may have on the possibilities of changing attitude and reaction. The significance of individual charcteristics will be evaluated in the same way.

In the final chapter the results of the investigations will be discussed and commented upon, especially from the point of view of their reliability and of the possibility of generalizing their results.

CHAPTER 2

ANNOYANCE REACTIONS

To study the effects to which an external environmental factor may give rise, one generally proceeds from the stimulus factors, which are usually well known and can be characterized by a number of clearly defined variables. As regards sound, for example, the stimulus consists of the elastic oscillations in the air which are transmitted to the ear, in which the mechanical oscillating motion is converted into nerve impulses and is perceived in the brain as a sound impression. These elastic oscillations can be objectively described in respect of frequency and sound pressure level.

Annoyance reaction means the subjectively experienced discomforts following exposure to a stimulus, irrespective of whether the experience manifests itself in an externally observable behaviour or not. It may be assumed that the stronger the annoyance reaction, the greater is the probability that it will be manifested in an externally observable behaviour or action. Several methods can be used for studying the effect on the individual of a disturbing stimulus, e.g. the effect of noise on the autonomic nervous system. (Noise as a public health hazard, ASCHA Report No. 4 1969, Lukas, Peeler and Kryter 1969, Harmon 1933), on depth of sleep (Lukas and Kryter 1968, Steinicke 1957), on working capacity (Teicher 1963, Laird 1963) and on the power of concentrations (Lang and Jansen 1967, Jerison 1957). The results of these studies cannot, however, be used as basis for a total evaluation of the effect on the individual.

The only practicable means today for studying the annoyance reactions is to use survey techniques for measuring. This technique came into use in the USA some 15 years ago and in Sweden a few years thereafter. Even in these earliest studies consideration was paid to the fact that the annoyance reaction reported was the result not only af characteristics of the stimulus but also of the exposed person's subjective valuations.

It must be considered difficult to distinguish the subjective and objective conditions for the experience of annoyance. Knowledge of the characteristics of stimulus, individual and environment which have a significance for the eliciting of a given reaction is, however, important to obtain, as it would permit a prediction of the reaction a given stimulus would give rise to in different groups of individuals. The problem is, therefore, to

find the best explanation of differences in reaction, the best explanation being taken to be that, which, with the least margin of error, can predict how different groups of individuals react to a given stimulus.

2.1. Structure of the annoyance reaction

An individual is exposed to various physical, chemical and biological stimuli in his environment. Examples of such stimuli are noise from aircraft or air pollution from a factory. At the same time the individual is exposed to various social stimuli which may give rise to different norms, valuations, knowledge and attitudes.

Physical, chemical and biological factors give rise to stimuli in the brain. Because of physiological differences between individuals, e.g. reduced hearing, however, a given factor need not produce the same stimulus in different individuals. The stimulus in turn gives rise to an evaluation of it. The evaluation is affected also by other stimuli, which may have a masking or cumulative effect. The evaluation is also affected by factors associated with the individual, e.g. the attitude to the stimulus, and by the individual's situation at the time of exposure, e.g. the activity in which the individual is engaged. The propensity for noticing a specific stimulus may also be dependent on the mental state of the individual.

The evaluation of a stimulus arising in this way may produce different kinds of bother which may be correlated to one another. In the sequel an attempt will be made to divide this bother into different categories, after which the separate categories will be discussed.

The various categories of bother which may be considered to exist consist of activity disturbance, physical disturbance and symbolic disturbance. Activity disturbance are mainly disturbance of sleep, rest, relaxation, conversation, manual precision work and "intellectual" work, learning, reading etc. As regards sleep this disturbance may be manifested in waking from sleep, changed depth of sleep, or difficulty in getting to sleep. As regards the other activities the disturbance consists mainly of speech interference or difficulty of concentration. The occurrence and the extent of the activity disturbance is dependent, apart from their evaluation, on the activity or activities in which the individual is engaged at the time of exposure and, in the case of some activities, on the need of the individual to carry out the particular activity or activities.

Physical disturbance is, in part, direct physical discomfort, such as sensation of pain, in part the physical disturbance which may arise in the form of fatigue, headache, nausea, palpitation of the heart, rise of blood

pressure, or fright. The extent of physical disturbance is mainly dependent on individual disposition.

Exemples of symbolic disturbance are effects of stimuli which recall something unpleasant to the individual or which cause fear, for example of air accidents. This disturbance is affected by—and affects—such factors as the individual's conception of the significance of the external environmental factor, the possibility and the will on the part of those responsible for the exposure to reduce the annoyance, and the norms and frames of reference possessed by the individual for valuation of a disturbing external environmental factor. Thus, here again, attitudes play a significant role.

These various types of disturbance to which a stimulus may give rise may also be interrelated. Disturbance of sleep may give rise to fatigue, which in turn may affect the ability to perform certain activities.

In the individual's interpretation and grading of his total disturbance due to a stimulus, the various components of the stimulus will differ in their significance. Activity disturbance, physical disturbance and symbolic disturbance may each give rise to an annoyance reaction, but there are probably fairly strong relations between them. Furthermore the total disturbance is affected by social norms and valuations.

The attitude to the source of disturbance thus affects the annoyance reaction in different respects. Attitude thus embraces all of the lasting positive and negative valuations, feelings and tendencies to action vis-a-vis the external environmental factors.

In the sequel we shall consider the annoyance reaction and its dependence on attitude to the source of disturbance, and factors which may be considered to condition this attitude.

2.2. Earlier studies of annoyance

No systematic analysis has previously been made of these problems. In order to gain information about the factors in the individual and his environment which may be of importance for the annoyance reaction, therefore, a number of investigations made in Sweden and abroad have been studied in respect of the factors which directly or indirectly may constitute the attitude to the source of annoyance and the relation of these factors to the annoyance reaction.

In an investigation in 1954 of the relations between sound level on exposure to aircraft noise and the frequency of annoyed persons Borsky (Borsky 1954) found that a relation existed between the attitude to aviation and its economic significance, on the one hand, and the experience of

annoyance on the other. The frequency of annoyed persons was significantly greater among those who did not consider aviation important.

In a later investigation in 1961 the same author (Borsky 1961), from interviews with persons resident within different zones in the vicinity of three airfields, found a relation between the annoyance reaction and such factors as flying experience, attitude to the importance of the airfield and their dependence on it, fear of air accidents, and their opinion on the efforts of the Air Command to reduce the annoyance, all of which factors reflect the attitude to the source of annoyance.

In an investigation in 1963 of aircraft noise nuisance in the vicinity of London Airport, McKennel (McKennel 1963) found a relation between annoyance reaction and attitude both to aviation and aircraft noise. In a Swedish aircraft noise investigation at Halmstad and Bromma (SOU 1961:25), primarily in order to study to what extent Borsky's (Borsky 1954) results were valid for Swedish conditions, flying experience was found to be related to the experience of annoyance. In another Swedish investigation at Linköping (Berlin, Jonsson and Kajland 1964) a positive relation was found between the attitude to the airfield and the experience of annoyance.

To study the annoyance reactions to sonic booms from jet aircraft Borsky (Borsky 1965) made a cross-sectional investigation in 1965 of the exposed poulation in Oklahoma, USA. There was a great difference in frequency of annoyed persons between groups of respondents who considered tests with sonic booms necessary and those who considered them unnessary.

Apart from investigations of nuisance from aircraft noise, studies have been made of the effect of other external environmental factors on persons exposed to them. An investigation of the noise disturbance from an artillery range (Cederlöf et al. 1964) showed a correlation between experience of annoyance and the attitude to the noise and its effect on health. A comparative study (Jonsson et al. 1969) of the nuisance from motor traffic noise in Stockholm, Sweden, and Ferrara, Italy, was made in 1966 to discover whether a difference in response existed between Italian and Swedish population groups. The results show that the frequencies of annoyed persons were higher in Stockholm than in Ferrara despite the lower noise level in Stockholm. This difference may possibly be explained by differences in the frames of reference of the individuals for evaluation of the annoyance reactions.

The relation between annoyance reaction and attitude to local government service was illustrated in a study of the annoyance due to bad smell from

a sulphate pulpmill at Mörrum in 1964 (Cederlöf et al. 1964). Those who considered the community services (medical, schools, shops, employment, housing) satisfactory showed a lower frequency of annoyed persons than other groups.

The investigation that has thrown most light on the problem of the attitude factor in annoyance reaction was a laboratory experiment to study the effect which the attitude to a source of noise may have on the annoyance reaction (Cederlöf et al. 1961). Eighty persons took part in the experiment, divided into four groups according to age and sex. They made pairwise comparisons of seven forms of motor vehicle noise from the annoyance aspect: 2 autocycle noises, 2 motor cycle noises, 2 motor car noises and 1 lorry noise. To evaluate the effect of the respondents' attitudes to the vehicles, the noise from the first three types of vehicle was related either to a "utility" situation or to a "non-utility" situation. The utility vehicles consisted of a delivery-boy autocycle, a serviceman's motor cycle and a taxi, and the nonutility vehicles of a teen-ager autocycle, teen-ager motor cycle and teen-ager motor car. At the same time as they were exposed to the noise, the subjects were shown a slide of the vehicle from which the noise was said to come. Scale values were calculated on the basis of the relative number of choices assigned to the various noises in the pairwise comparison. Noise from vehicles in a utility situation was judged throughout to be less annoying than from vehicles in a non-utility situation.

It was also found in this study that, when the utility and non-utility situations were compared, the difference in annoyance was greatest for passenger cars and least for autocycles. Autocycles in the utility situation caused roughly the same nuisance as in the non-utility situation, while the difference for passenger cars was relatively great. The difference was also rather greater at 60 dB(A) than at 80 dB(A). The disturbing effect consequently differs for equivalent stimuli depending on differences of opinion on and attitude to them.

To summarize, on the basis of the reported annoyance studies, the following factors may be said to be most important for differences in annoyance reaction between individuals:

A. The opinion on and valuation of the source of annoyance.

If the exposure is an inevitable consequence of a necessary process, one is more tolerant than if the process is considered unnecessary.

B. The opinion on the possibility of reducing the annoyance.

This includes considerations of whether those responsible for the exposure are doing everything possible to reduce the annoyance.

C. Other disamenities experienced in the environment.

The more dissatisfied a person is with different factors in his environment, the less he seems to accept the particular source of annoyance; this may be true if the source constitutes an addition to the sources of his dissatisfaction with his environment.

D. Effect on health.

Those who consider that the exposure may give rise to effects on their health are bothered to a greater extent than others.

E. General sensitivity.

Those who consider themselves sensitive to noise in general seem to be less tolerant both to noise and to air pollution.

F. Fear of exposure.

This is presumably the factor which, above all, may give rise to differences in reaction between aircraft noise and other stimuli. Those who are afraid of air accidents are usually bothered to a greater extent by aircraft noise than by other forms of noise. The noise is in this case considered as a danger warning signal.

G. Individual variables.

Individual structure characteristiscs such as age, sex, social class, size of family, period of residence etc. have been found only to a very small extent to be correlated to the annoyance reaction. Earlier experience of noise, as also the experience of the residential area as quiet or noisy, has to some extent been found to have a significance for the annoyance reaction.

The reported studies show without exception higher frequencies of annoyed persons in groups which directly or indirectly have a negative attitude to the source. They do not, however, give any direct indication of whether the extent of annoyance is primarily determined by attitudes, and in such case under what conditions this may occur, or whether the annoyances as such are responsible for the attitude. It has been clear, however, that the physical characteristics of the stimulus alone do not determine the degree of annoyance. The relation between attitude and annoyance reaction will be considered in greater detail in the sequel.

CHAPTER 3

CHANGES OF ATTITUDE AND ANNOYANCE REACTIONS

From the preceding chapter it is evident that the majority of researchers who have studied annoyance reactions to emmissions have reckoned on an association between the annoyance reactions and factors such as the attitudes to those responsible for the exposure, the opinion on the general importance of the source or on the authorities' willingness to intervene in the event of serious exposure conditions. But in no case has the complicated interplay between these functional factors and the annoyance reactions been analysed in detail from the point of view of the influence of the functional factors on the reaction.

In the preceding chapter an assumption was made that the annoyance reactions are dependent on the attitudes to the source of annoyance, a negative attitude being accompanied by a greater experience of annoyance and a positive by a lesser. A change of attitude in a positive direction would thus reduce the annoyance and in a negative direction would increase it. If this assumption is correct, it means—at least theoretically—that the subjectively experienced annoyances to which an external environmental factor may give rise can be changed.

The laboratory experiment (Cederlöf et al. 1961) reported in Chapter 2 shows that the bother reaction is dependent not only on stimulus factors but also on the individual's opinion on and attitude to these stimuli. No attempts were made in the experiment, however, to change the individual's attitude to the sources of noise or to study whether this affects the reaction. This would require manipulative experiments.

The literature on social psychology contains a number of reports on attempts to change the attitude of experimental subjects (Secord and Backman 1964, Newcomb, Turner and Converse 1965, Krech, Crutchfield and Ballachey 1964, Brown 1963, Israel 1959). But there have been few field experiments aimed at producing lasting changes of attitude in whole population groups. The reason for this is probably a disinclination on ethical grounds to manipulate with people in this way, and also that such manipulation is difficult to arrange in practice.

There are nevertheless numerous practical examples of conscious attempts at changing attitudes. In publicity and advertising campaigns, for example, and in elections, an attempt is made to alter the attitude of certain population groups and to reinforce attitudes in others. The effect of the attempts,

however, is counteracted by the fact that the individuals are fully aware that an attempt to influence them is being made and why.

Attempts to influence entire population groups utilize mainly the mass media, such as radio, TV, the press, and printed matter, but also opinion-makers who work in direct personal contact with individuals and groups. The latter method, however, is relatively laborious and is used consciously only to a limited extent.

Experiments in change of attitude by conventional means—e.g. through the dissemination of information—have often had poor results. Sometimes it has been impossible to achieve any change at all, somtimes different degrees of change in the desired direction have been noticeable, but usually slight and of brief duration (Sherif and Sherif 1956). Two conceivable reasons have been indicated:

1. To change attitude through direct information is rendered difficult by the self-selection mechanism, i.e. the mechanism that makes the individual accessible by and large only to the information which in one sense or another is relevant to him or her. How the selection mechanism functions in the individual case depends on the individual's frame of reference, which in turn derives both from individual characteristics and from the norms of the social group to which the individual belongs.
2. Attitudes often form part of a larger attitude complex, which constitutes an essential part of the personality, and are therefore often resistant to new impulses. In such cases individual attitudes are also difficult to change.

Although earlier studies have usually demonstrated only small changes and of brief duration, one cannot rule out the possibility of bringing about major and lasting changes of attitude to a source of bother, as the source often constitutes a particular problem which the exposed individuals usually do not relate to a given attitude. This means that it is more difficult for the individual to guard against attempts at changing his attitude.

The effects of the attempts at chainging the attitude can be estimated by studying the individual's attitude structure both before and after the period in which the influence is brought to bear, and any changes in attitude structure can thus be related to the influence. One can also work with two equivalent population groups, one of which is being manipulated, and a comparison between the attitude structures of the two groups will then provide a measure of the effect of the influence.

From the methodological standpoint the former method, of attitude measurement before and after influence, has the disadvantage that a change of attitude may occur between the two occasions of observation without being a result of the attempts to influence. The method of attitude measurement only after influence has been brought to bear usually means that the change solely for the group (the net change) and not for the individual (the gross change) can be studied and, moreover, presumes that an influence is brought to bear only on the experimental group, while the control group remains intact. This, again, involves difficulty in evaluating the result, especially if the groups are taken from the same geographical area, since contact between them cannot be excluded.

In the present experimental investigations the measurement of attitude has been made only after the influence had been brought to bear, as the main object was to study any changes in frequency of bothered persons in the two groups.

The first step in the series of investigations, directly aimed at elucidating the relation between attitudes to the source of bother and the reactions to physical factors of relevance for environmental hygiene, consisted of a laboratory experiment. In this experiment, which is described in section 3.1, a study was made of the possibility of creating certain attitudes to the source of bother and thus possibly to change the reaction to it.

The aim of the laboratory experiment, however, was merely to study whether attitude constitutes an annoyance factor. In order to be able to generalise the results to apply also under field conditions—in which the respondents have been exposed to noise during a lengthy period and have thus formed distinct attitudes to the source—a manipulative field experiment is required in order to study the effect of a change of attitude brought about in the field. A field experiment was therefore made and is described in section 3.2.

Even if it is possible to recognize changes of attitude and annoyance in these laboratory and field experiments, one does not know whether they are of a temporary nature or not. To gain information concerning the constancy of changes of attitude and of reactions to disturbance, it is necessary to study not only the possibilities of changing the attitude and reaction but also the lasting effect such a change may have. This has been done by a later follow-up of the results of the field experiment. This study is presented in section 3.3.

The empirical studies will be reported and commented upon in the sequel of this chapter.

3.1. CHANGES OF ATTITUDE AND ANNOYANCE REACTIONS. RESULTS OF LABORATORY EXPERIMENT

The object of the laboratory experiment reported below was to illustrate the possibility of changing certain attitudes in a group of subjects, so bringing about differences in frequency of annoyed persons between this group and an uninfluenced control group. The fundamental principle is that individuals who have been rendered relatively positive to the exposure situation would react differently, from the point of view of disturbance by the same stimulus, from individuals rendered relatively negative to the situation.

The expected effect of the influencing of attitude may be summarized in the following hypothesis:

A group influenced in a positive direction to aircraft or motor vehicles exhibits a lower frequency of annoyed persons, and a group influenced in a negative direction a higher frequency than a group not exposed to the influence.

3.1.1. Arrangement and conduct of the experiment

The experimental material consisted of a total of 266 students of sociology at Stockholm University in the spring term of 1964, of whom 154 female and 112 male. They were divided into three groups, the object being in one group to change the attitude of the subjects to the source of annoyance in a posive direction, in another group in a negative direction. The third group constituted a control group and was not subjected to influence. The positive group contained 92 persons, the negative 93, and the control group 81. The exposure to noise was done groupwise, after which the respondents indicated the degree of annoyance they considered that the exposure had given rise to. The arrangement of the experiment is shown in the table below.

Control group	Experimental group I	Experimental group II
—	Positive influence on attitude (Aircraft)	Negative influence on attitude (Aircraft)
Exposure to noise (Aircraft)	Exposure to noise (Aircraft)	Exposure to noise (Aircraft)
Measurement of annoyance	Measurement of annoyance	Measurement of annoyance
—	Positive influence on attitude (Motor vehicles)	Negative influence on attitude (Motor vehicles)
Exposure to noise (Motor vehicle)	Exposure to noise (Motor vehicle)	Exposure to noise (Motor vehicle)
Measurement of annoyance	Measurement of annoyance	Measurement of annoyance

One may assume that the neutral group—the control group—exhibits the annoyance distribution expected for both other groups. The differences between, on the one hand, the positive and the neutral and, on the other, the negative and the neutral groups may therefore be taken as a measure of the change of reaction caused by the change of attitude.

3.1.2. Influence on attitude

The attempt to create different attitudes to the source of noise was made by differently discribing the circumstances at the place where the noise was recorded. The group which it was wished to influence "positively" was given the idea that those responsible for the source of noise were attempting to make the conditions as tolerable as possible, the group which it was wished to influence "negatively" that they paid no consideration to the harmful effect of the noise on the population. The control group was given merely a brief description of the situation.

The stimulus consisted of aircraft noise and of noise from motor vehicles. The arrangement of the experiment will be seen from the table below.

Summary description of the exposure situation

AIRCRAFT	*MOTOR VEHICLES*
Neutral basic information (all groups)	
It was reported that the aircraft noise had been recorded in a residential area near a military airfield, the aircraft taking off in the direction of the residential area. About 40 take-offs per day.	The motor vehicle noise was said to derive from an arterial road of the same kind as was to be built close to an existing residential area.
Positive information ("positive influence group" only)	
It was stated that the Air Command had a large measure of understanding for the residents' problems and was willing to collaborate in their solution. The Command would do all in its power to reduce the noise problems and was grateful that no direct demand had been made for curtailment of flights but simply that the attempt should be made to avoid flying over the residential area.	The authorities were doing all they could to avoid future noise problems in the residential area. They had promised, if necessary, to build an embankment to screen off the noise, planted with quickly growing bushes and trees: also, if there were still any noise problems, to impose a speed limit on that section of road. A fence was naturally to be erected to prevent accidents.
Negative information ("negative influence group" only)	
It was stated that the Air Command was uninterested in such problems but merely wished to ensure that the training programme was carried out. The Command had also intimated that no noise problem existed, merely that the residents were overwrought and nervy.	The authorities had taken no action in providing any form of noise protection. They were unwilling to consider either an embankment for screening off the noise or a speed limit.

3.1.3. Exposure to noise

The noises had been tape-recorded, being kept at a constant level during the recording. The noise level was about 90 dB(A), which is a fairly high level.

The subjects listened to the recorded noise (two aircraft taking off in succession) and were then asked to try to put themselves in the situation of the residents and to estimate the degree of disturbance the noise gave rise to. It was especially emphasized that it was the disturbing effect that should be estimated, and that the results of their estimates might be used as basis for deciding what noise level could be considered acceptable.

3.1.4. Estimate of annoyance

To arrive at a common criterion for estimating the effect the respondents considered that the exposure gave rise to, a frame of reference was presented containing the possible alternative reactions of the subjects. The highest degree of annoyance, for example, corresponded to the view that the airfield—or arterial road—should be moved to a less populated area.

The various alternatives were formulated as follows.

	AIRCRAFT	MOTOR VEHICLES
Great annoyance	Airfield must be moved to less populated area.	Road must be moved.
Fairly great annoyance	Some restriction to traffic necessary (e.g. no take-off after 8 p.m.)	Some restriction of traffic necessary (e.g. speed limit).
No great annoyance	Admittedly disturbing, but some degree of inconvenience must be accepted.	Admittedly disturbing, but some degree of inconvenience must be accepted.
Negligible or no annoyance	Some disturbance occurs but nothing of note.	Some disturbance occurs but nothing of note.

The recording of the subjects' responses was done with en elopin apparatus * on which the experimenter could directly read the frequencies.

3.1.5. Results

The total number of disturbed persons within each group is shown in table 1. As so small a number stated that they suffered no great or no disturbance at all, these two categories together were taken as constituting the category which was least disturbed.

It will be seen from the table that the individuals who were "positively" influenced in favour of those responsible for the exposure exhibited a lower frequency both of "great" and "fairly great" disturbance compared with that which would have been expected if there had been no influence

* An elopin apparatus functions in the manner that every subject has a small box with two knobs. Each knob can be set to four positions. All boxes are connected to a central unit which records the settings (responses).

—the control group. In the same way the "negatively" influenced individuals exhibited a higher frequency of disturbed persons. This applies both to motor vehicle and aircraft noise. Thus, in the positively influenced group, there are only 14 % who consider the aircraft noise greatly disturbing, but 59 % in the negatively influenced group. Without influence on attitude rather more than one-third of each group should have experienced the aircraft noise as greatly disturbing. A significance test of the difference between the positive group and the control-group, with the great and fairly great annoyance categories lumped together, turned out to be significant ($\chi^2 = 23.05$, df = 1). The difference between the negative group and the control group is also significant ($\chi^2 = 5.11$, df = 1). *

Table 1
The frequency of disturbed persons in the respective influence groups

	AIRCRAFT			MOTOR VEHICLES		
	Positive influence	Neutral influence	Negative influence	Positive influence	Neutral influence	Negative influence
	n %	n %	n %	n %	n %	n %
Great annoyance	13 14	29 36	55 59	25 27	33 41	70 75
Fairly great annoyance	23 25	33 41	29 31	33 36	39 48	21 23
No great—no annoyance	56 61	19 23	9 10	34 37	9 11	2 2
Total	92 100	81 100	93 100	92 100	81 100	93 100

As regards motor vehicle noise about one-quarter of the positive group states it to be greatly disturbing, but three-quarters of the negative group. Without change of attitude about 40 % of each group should be greatly disturbed. A comparison between the positive group and the control group shows that the difference in frequency of disturbed persons is significant ($\chi^2 = 14.05$, df = 1), and likewise between the negative and the control groups ($\chi^2 = 4.45$, df = 1).

* All significance tests have been made at the 5 % level.

3.1.6. Comments

The results of this study show that, by changing the attitude to a source of emission, one can bring about changes of annoyance reaction in a laboratory experiment. On the other hand it is not possible to estimate from these results how great changes can be effected in annoyance reactions. The results also show that, as regards annoyance both from aircraft and from motor vehicle noise, a greater change has taken place in the group influenced in a negative direction. One reason for this may be that, owing to the strength of the stimulus the frequency of annoyed persons, even without influence of attitude, has been so high that there was considerably less scope for an increase than for a reduction of the frequency. But the reason may also be that the attempt to create a positive attitude succeeded better than that to create a negative attitude to the source.

The participating students hardly had any clearly developed pattern of response to noise stimuli before the experiments. It is therefore not possible to conclude from the results whether, in individuals with a more fixed pattern of response owing to personal experience of noise, a corresponding distribution of annoyed persons can in practice be produced by influencing of attitude. This question can only be answered with the help of data from manipulative field experiments.

3.2. CHANGES OF ATTITUDE AND ANNOYANCE REACTIONS. RESULTS OF FIELD EXPERIMENT

On the basis of the laboratory experiment which showed how the individual's experience of different disturbing factors in the external environment can be affected by his attitude to the source of annoyance, it is not possible to give a general answer to the question whether it is possible to change these attitudes and thus change the annoyance reactions in areas where the population is already exposed to annoyance and where attitudes and responses have presumably stabilized. An account is given below of a field study performed in order to throw light on this question.

In this field experiment two samples of population groups have been studied after one of them had been subjected to a positive influence of its attitude to a source of annoyance—an airfield. In the second group no influence was brought to bear. The expected direct effect of the influence on attitude—changes of attitude—and the effect of these attitudes—changed annoyance reactions—may be summarized in the following two hypotheses:

1. The experimental group exhibits on an average a more positive attitude to aircraft than the control group.
2. The experimental group exhibits a lower frequency of annoyed persons than the control group.

3.2.1. Arrangement and conduct of the experiment

In the choice of investigation area the requirements were that it should be homogeneous from the experimental aspect and should have a relatively high frequency of annoyed individuals whose attitude to the experimental condition (noise) could be changed in a positive direction, with a possible reduction of annoyance in consequence. For, on ethical grounds, it was considered unsuitable in a field experiment to exercise an influence which might lead to an increase of the annoyance.

An investigation carried out in 1963 (Berlin, Jonsson and Kajland 1964) at the request of the General Planning Committee in Linköping had demonstrated, for Swedish conditions, an unusually high frequency of annoyed persons in a residential area in the outskirts of the town. The residential

area was exposed to aircraft noise mainly from the nearby Air Force station at Malmslätt. In view of the high frequencies of annoyed persons and the homogeneity of the population this residential area was considered suitable for the planned field study.

From this population two equally sized groups of altogether 209 persons, of whom 186 could be interviewed, were selected at random. The drop-out, 23 persons, equally distributed between the experimental and control groups, will be seen from the table below.

Reason for drop-out	Experimental group	Control group
Refused	3	5
No reply	7	7
Others (ill.)	1	0
Total	11	12
Total interviews	94	92

The field work started on August 31, 1964, when the attitude material was sent to the experimental group. The interview work started on September 10 and continued for fourteen days.

3.2.2. Influence on attitude

Through the arrangement of the experiment, with the members of the experimental and control groups resident within the same geographical area, it was necessary to attempt to influence every individual in the experimental group separately. This procedure was used in order to maximize the influence on individuals in the experimental group and to minimize the influence on individuals in the control group. The influence on attitude was therefore brought to bear by circulating to each of the respondents in the experimental group a questionnaire form. This form contained positively leading questions, partly relating to knowledge and partly of an emotional character (see appendix 1).

To increase the prospects of bringing about a change of attitude the members of the experimental group were further informed of parts of the results of the survey, which showed that people within the area had a

positive attitude to the Air Force. Together with this account they were presented with a book, "50th Anniversary of the Royal Swedish Air Force". This was done irrespective of whether the individual had answered the questionnaire or not.

3.2.3. Exposure to noise

The area was exposed to the noise of military jet aircraft. Altogether 4000—5000 take-offs per annum were made from the airfield at the time of the investigation, most of which in daytime. The noise level measured in the investigation area varied for individual flights over the area between 70 and 110 dB(A).

3.2.4. Measurement of response

The measurement of response has two main aims, to study whether the influencing of attitude had any effect or not and to chart the annoyance reactions in both groups.

For the interviews with the respondents both in the experimental and control groups a questionnaire was used, practically identical to that in the earlier survey from the spring of 1963 (Berlin, Jonsson and Kajland 1964). Persons who did not answer the questionnaire were also interviewed. The investigation was presented to respondents as a survey of general satisfaction, designed to chart the attitude of the population to its housing and to the residential area. The questionnaire survey and interview survey were conducted entirely separately. The interview form contained, first, some questions concerning the respondent's background and housing conditions and indirect questions concerning the annoyance of aircraft noise in the form of questions relating to general satisfaction. Subsequent questions dealt with the annoyance caused by aircraft noise and to some extent the form in which annoyance was manifested (see appendix 2). Finally some questions were asked concerning the attitude to aircraft. Attitude to aircraft was also studied by means of an attitude scale consisting of 28 statements. The respondents gave an estimate, in a five-degree scale, of the extent to which they could agree with the respective statements. Of the 28 statements it was found, in a test of another group according to the criteria of Likert (Edwards 1957), that nine discriminated satisfactorily between persons with a positive and those with a negative attitude to aircraft.

3.2.5. Results

An account will first be given of the results relating to the attitude complex, followed by the results of the bother reactions in the experimental and control groups.

The results of the measurements of attitude to aircraft in the experimental and control groups are summarized in table 2.

It will be seen from the table that, for eight of the nine statements, there are relatively more individuals with a negative attitude to aircraft in the control group than in the experimental group. For six of the statements the differences are statistically significant. The only statement which did not produce a difference in the expected direction was: "Our society spends an unnecessary amount of money on aircraft".

The hypothesis that the attitude of the control group to aircraft would be more negative than that of the experimental group may thus be considered to be verified, i.e. the influence on attitude has had effect.

For a study of the bother reactions a measure of response has been used which is based on the estimates made by the respondents of the intensity of the disturbance and the frequency of disturbing occasions. A more detailed presentation of this measure of response will be found in appendix 3. The implication of the four classes of bother will be seen from the table below.

Index	Implication
0	Undisturbed
1 (slightly bothered')	Not particularly bothered—at most a couple of times a week. Fairly greatly disturbed—seldom.
2 (fairly greatly bothered)	Not particularly bothered—daily. Bothered fairly greatly—at most a couple of times a week. Greatly bothered—seldom
3 (greatly bothered)	Fairly greatly bothered—daily. Greatly bothered—at least once a week.

The total number of bothered persons within the respective attitude groups will be seen from table 3 below.

Table 2

Distribution of responses to attitude questions within the experimental and control groups and the results of χ^2-analysis of the distribution

Statement	Experimental group (n = 94)		Control group (n = 92)		χ^2 (df = 1)
	Negative attitude %	Other %	Negative attitude %	Other %	
1. Our society spends an unnecessary amount of money on aircraft.	28	72	18	82	—
2. It's no worse living near an airfield than anywhere else.	52	48	72	28	6.77
3. Noise from an airfield creates dissatisfaction in the community.	34	66	71	29	23.52
4. The worst thing about aircraft noise is that it comes irregularly.	41	59	52	48	1.72
5. When aircraft fly low there is a risk of windows breaking.	28	72	43	57	4.42
6. Aircraft noise is no worse than the noise from any other traffic.	32	68	57	43	10.44
7. Aircraft noise is taxing to the nerves.	44	56	74	26	16.36
8. The development of private aviation should be assisted in every possible way.	6	94	15	85	2.92
9. One easily gets used to aircraft noise.	28	72	43	57	4.41

Table 3

Frequency of bothered persons in experimental and controls groups

	Experimental group		Control group	
	n	%	n	%
Undisturbed	44	47	19	20
Slightly bothered	17	18	9	10
Fairly greatly bothered	11	12	22	24
Greatly bothered	22	23	42	46
Total	94	100	92	100

From table 3 it will be seen that four-fifths of the members of the control group are bothered as against only about one-half in the experimental group. The control group may be assumed to exhibit the frequency of bothered persons which the experimental group would have had if no influence on attitude had been brought to bear. The hypothesis that the frequency of bothered persons would be lower in the experimental than in the control group has thus been verified ($\chi^2 = 13.06$, df $= 1$).

The hypothesis also implies an expectation of a relatively higher frequency of bothered persons in the highest bother classes in the control group. The results in table 3 are in agreement with this expectation. One-third of the respondents in the experimental group state that they are greatly of fairly greatly bothered while the corresponding figure in the control group is slightly more than two-thirds. The difference is statistically significant ($\chi^2 = 20.76$, df $= 1$).

In conjunction with the disturbance problem questions were also asked as to whether the respondent was woken by aircraft noise and how often this occurred. The results are shown in table 4.

As will be seen, 11 respondents out of 94 in the experimental group and 22 of 92 in the control group were woken once or twice a month or more often. The difference, which supports the hypothesis, is statistically significant ($\chi^2 = 3.95$, df $= 1$).

Table 4

The frequency of respondents in the experimental and control groups who were woken by aircraft noise once or twice a month or more often

	Experimental group		Control group	
	n	%	n	%
Woken once or twice a month or more often	11	12	22	24
Others	83	88	70	76
Total	94	100	92	100

3.2.6. Comments

The results of the field experiment show that it is possible, by influencing the attitude to the source of nuisance, to change the annoyance experience from it. Thus the "greatly bothered group", the group which is usually considered in questions concerning the admissibility or non-admissibility of exposure, has been reduced to half through the influence on attitude. Disturbance of sleep is also stated to occur to a lesser extent in the group which had undergone a change of attitude.

In the questionnaire circulated in order to influence the respondents' attitude, there was a fairly great drop-out—more than one-third did not reply. These individuals, however, were included in the actual investigation of annoyance to avoid a skew selection effect in the experimental group. The size of the drop-out may, however, indicate that the attempt at influence did not succeed to the full extent. It is at all events uncertain to what extent the respondents who did not return the form had read it. The same applies to their reading of the report of the results of the investigation and the gift book sent with it.

The possibility of generalization of the results is limited by a couple of factors. Influence was brought to bear through a special, indirect method, which may more or less have rendered the defence mechanisms of the respondents against influence inoperative—self-selection, tendency to accept social influence etc.—and has therefore been more effective than other methods which assume that the individual is conscious that an influence is being exerted. The material, furthermore, cannot be regarded as representative of an "average population". In the first place this material has been exposed to aircraft noise of an extremely high level, at least by

Swedish standards, implying not only exceptionally high frequencies of annoyed persons but also a clear consciousness of the annoyance and therefore presumably a more stable attitude structure than an "average population" can be expected to have. It may also be presumed that the earlier survey within the area and the debate on aircraft noise problems that had taken place in the town had brought about a special engagement in the aircraft noise questions. The questionnaire which was circulated should therefore have been of unusually great interest for the respondents.

3.3. CHANGES OF ATTITUDE AND ANNOYANCE REACTIONS. RESULTS OF INVESTIGATION OF THE CONSTANCY OF THE CHANGES

The laboratory and field experiments reported both had the aim of studying whether it is possible, through influencing of attitude to a source of annoyance, to obtain a changed structure of attitudes and annoyance in the respondents. The problem of the constancy of the changes has, however, not been dealt with in the experiments.

The object of the investigation reported below, therefore, was to study the magnitude of the residual effects, if any, of the influence on attitude and the associated change of annoyance. This could be done by following up, three years later (1967), the results of the field experiment made in 1964 (see section 3.2).

3.3.1. Arrangement and conduct of the investigation

In the field experiment aimed at studying whether it was possible to bring about a change of annoyance by changing the attitudes to aircraft, 186 persons took part. Of this number 161 persons remained three years later in 1967, roughly equally distributed among the two experimental groups.

Of the 94 respondents who were members of the experimental group in 1964, 80 were still living in the area in 1967, while of the 92 members of the control group there were 81 persons still in the area.

The actual drop-out—those who were still living in the area but could not be interviewed—is here 7 % (11 persons), 6 of whom from the experimental group and 5 from the control group. The reasons for the drop-out will be seen from the table below.

Reason for drop-out	Experimental group	Control group
Refused	2	2
No reply	4	3
Total	6	5
Total interviews	74	76

The field work was carried out in the autumn of 1967.

3.3.2. Exposure to noise

The exposure has been slightly changed between the two occasions of investigation. According to information from the local air command the frequency of take-offs has diminished somewhat, while at the same time there has been a change to a more noisy type of aircraft. On the basis of changed exposure conditions one might expect, in total, a rather higher frequency of annoyed persons than found in 1964.

3.3.3. Measurement of response

The follow-up was conducted on the same principles as the earlier study, i.e. the aim of the interview was masked, the same interview form was used and the interviewers did not know to which group—control or experimental—the respondents belonged.

To study the structure of attitudes and annoyance the same procedure as before was used (see section 3.2.4).

3.3.4. Results

The results are reported first in respect of attitudes to the aircraft and thereafter in respect of the frequencies of bothered persons within the respective groups. An analysis is finally made of the individual stability between the two occasions of investigation within the two groups.

The distribution of responses to the attitude questions will be seen from table 5.

It will be seen from the table that, for all statements except the first, there are relatively more individuals with a negative attitude to aircraft in the control group than in the experimental group. The total difference between the two groups, compared with the results of the earlier investigation, has been slightly reduced, but the tendency is clear. Thus it may be said that the difference of attitude found earlier between the experimental and the control groups still existed after three years.

A comparison between the experimental and control groups was made also in respect of the change of annoyance caused by the change of attitude. The annoyance index used earlier, with the categories "undisturbed, slightly bothered, fairly bothered and very bothered", is also used in this material. The results are shown in table 6.

Both in the experimental and control groups there has been an increase in the frequency of bothered persons, as expected on the basis of exposure.

Table 5

Distribution of responses (%) to attitude questions within the experimental and control groups and the results of χ^2-analysis of the distribution

Statement	Experimental group		Control group		χ^2	χ^2
	Negative attitude 1967 (n = 74)	Negative attitude 1964 (n = 94)	Negative attitude 1967 (n = 76)	Negative attitude 1964 (n = 92)	1967 df = 1	1964 df = 1
1. Our society spends an unnessary amount of money on aircraft.	31	28	22	18	—	—
2. It's no worse living near an airfield than anywhere else.	58	52	72	72	2.76	6.77
3. Noise from an airfield creates dissatisfaction in the community.	46	34	63	71	3.81	23.52
4. The worst thing about aircraft noise is that it comes irregularly.	59	41	76	52	4.15	1.72
5. When aircraft fly low there is a risk of windows breaking.	35	28	38	43	0.05	4.42
6. Aircraft noise is no worse than the noise from any other traffic.	62	32	86	57	9.46	10.44
7. Aircraft noise is taxing to the nerves.	64	44	83	74	6.24	16.36
8. The development of private aviation should be assisted in every possible way.	7	6	21	15	5.23	2.92
9. One easily gets used to aircraft noise.	43	28	62	43	4.48	4.41

Table 6

Frequency bothered persons in experimental and control groups.
(The figures within brackets are those from the 1964 study)

	Experimental group			Control group		
	n	%	(1964)	n	%	(1964)
Undisturbed	26	35	(47)	8	10	(20)
Slightly bothered	11	15	(18)	9	12	(10)
Fairly bothered	11	15	(12)	12	16	(24)
Very bothered	26	35	(23)	47	62	(46)
Total	74	100	(100)	76	100	(100)

Thus in the experimental group the frequency of bothered persons had increased by 12 % and in the control group by 10 %. The difference between the two groups remains, however. In the experimental groups altogether 65 % were disturbed by aircraft noise and in the control group 90 %. The difference is statistically significant ($\chi^2 = 11.59$, df = 1).

It will also be seen from table 6 that the difference in frequency of bothered persons between the two groups is greatest in the highest class of bother. In the experimental group 35 % are greatly disturbed as against 62 % in the control groups. The difference between the groups at this bother level—which has even increased a few per cent between the two occasions of investigation—is statistically significant ($\chi^2 = 9.66$, df = 1).

In the 1964 study a difference was also found between the experimental and control groups as regards the frequency of respondents who were woken by the noise. At that time 12 % in the experimental group and 24 % in the control group said that they were woken by aircraft noise at least once or twice a month. On the later occasion 11 % and 25 % respectively stated that they woken by the noise at least once a month (table 7). The difference between the groups is significant on the latter occasion as well ($\chi^2 = 4.20$, df = 1).

Table 7

Frequency of respondents in the experimental and control groups who were woken by aircraft noise once or twice a month or more often

	Experimental group		Control group	
	n	%	n	%
Woken once or twice a month or more often	8	11	19	25
Others	66	89	57	75
Total	74	100	76	100

3.3.5. Comments

In this follow-up of the 1964 study of the exposure to noise in Linköping, higher frequencies of bothered persons and a higher intensity of bother were found both in the experimental and the control groups than in the previous study. The explanation is probably the change to a more noisy type of aircraft.

The results of the investigation show that the change of annoyance consequent on a change of attitude is not only of a brief nature but has a lasting effect on the individuals exposed. Admittedly the differences of attitude arising between the experimental and control groups have been slightly reduced during the period, but no reduction in the difference between the groups has been found as regards the frequency of bothered persons. The earlier difference found between the two groups in frequency of persons woken by aircraft thus still remains.

A problem in investigations of this kind is the drop-out. This includes those who have moved from the area or died between the two periods, and accordingly cannot be considered to form part of the defined population, and those who do not reply or refuse to be interviewed. As regards those who have moved from the area it may be noted that in earlier investigations within that area no relation was found between the exposure conditions and the tendency to leave the area (Berlin, Jonsson and Kajland 1964). This observation is in agreement with the fact the tendency to move from the area has not been markedly great in either group—14 and 11 respectively. The actual dropout—those who remained in the area but could not be interviewed—is relatively uniformly distributed between the two groups of experimental persons.

CHAPTER 4

FACTORS WHICH AFFECT THE POSSIBILITY OF CHANGING THE ATTITUDE TO A SOURCE OF ANNOYANCE AND THE ANNOYANCE REACTIONS

According to the results reported in chapter 3 the annoyance reactions to external environmental factors can be changed by changing the attitude to the source. In this connexion no consideration has been given to the question of the conditions under which changes of attitude, with the consequent changes of annoyance, are possible. Several authors have pointed to the possibility that change of attitude is dependent not only on the measures taken to bring it about but also on factors associated with the source and on characteristics of the population affected (Osgood, Suci and Tannenbaum 1957, Fishbein 1967, Klapper 1960).

Of the characteristics of the stimulus which may be relevant to the possibility of changing the annoyance reactions through a change of attitude, the intensity of the stimulus should be of very great significance. It therefore seems reasonable to suppose that, if an individual is exposed to a noise of so high a level that it causes a sensation of pain, all or practically all people would classify the noise as disturbing. On the other hand a noise of so low a level as to be hardly perceptible would be classified by all or practically all people as undisturbing.

Between these limits one may presume that the annoyance reactions are manipulatable by influencing of attitude and that the possibility of manipulation should diminish with increasing noise level up to the threshold of feeling if the noise is of a level to be distinctly audible.

It has also been shown on a number of occasions that the result attained in the attempt to change a person's attitude is dependent on the characteristics of the system of attitudes of the individual (Maccoby, Newcomb and Hartley 1958, Prohansky and Seidenberg 1966). A problem of interest is then how the formation of attitude in the individual arises, as this can affect the possibility of change. A complete analysis of this complex problem lies outside the scope of this study, but it may be briefly mentioned that the satisfaction of need, information, and group influence are essential elements in the attitude structure (Rosenberg 1956, Morrissette 1958, Gilbert 1951). An individual will therefore develop positive attitudes to the objects which satisfy his need and negative attitudes to those which prevent satisfaction of his need. Attitudes develop also as a consequence of the information

concerning the object that the individual receives (Nowak, Carlman and Wärneryd 1966). The information reaching the individual—whether correct or not—constitutes a selection of the facts known about the object. As the exposure takes place selectively, this selection of existing facts will be of such kind as to accord with already existing clusters of attitudes. This tendency will be further accentuated since the groupings in the society to which the individual belongs affect and reinforce the attitudes possessed by or developed by the individual. This implies accordingly that the attitude possessed by the individual to the object—the source of noise—in relation to other objects affects the possibility of change. Thus, if an individual considers an airfield of importance for himself or for the community and its development, he will presumably have a more positive attitude to the source of noise than if he considers it unimportant. Differences in experience of annoyance would thus exist between groups of individuals depending on their attitude to the source of annoyance.

The possibility of influencing the attitude is also dependent on the characteristics of the attitude to be changed. In this context it may be of value to refer to Guttman's classification of attitudes in four components, viz. content, intensity, closure and involution (Lazarsfeld 1954). Content means how strong the positive or negative reaction of an individual is, intensity is the strength with which the attitude is experienced. The relation between content and intensity is described, according to Guttman, by a U-shaped curve, i.e. the more extremely negative or positive an individual, the higher the intensity of the attitude.

The component which Guttman calls closure proves in his studies to be described by the decidedness with which individuals abide by their responses. The relation between content and closure has, according to Guttman, the form af a N-shaped curve, the individuals furthest to the left on the curve being the most negative. They hold no definite opinion but have a very negative attitude to the prevailing conditions. On the far right are the respondents who have a very positive attitude which they maintain with great firmness, while the slightly positive are very undecided in their opinion. The respondents who are slightly negative to the prevailing situation have a distinctly decided opinion.

The fourth and last of the components which Guttman worked with was involution. The relation between involution and content may be described by a M-shaped curve.

Individuals who are not involved in the object are usually neutral, but if in exceptional cases they nervertheless have a definite opinion, they are

presumably prejudiced and in such case either strongly positive or strongly negative. The strongest involution should then exist in those who are either slightly positive or slightly negative.

On the basis of Guttman's attitude components, accordingly, the possibility of effecting a change of attitude should be greater in the group with low intensity in its attitudes than in the group with high intensity. Correspondingly those with strongly definite attitudes should be more resistant to change, like individuals who have a strong personal involvement in the object.

In conjunction with the studies which showed the direction of the relation between attitudes to the source of annoyance and the experience of annoyance there is still another problem to be considered, namely whether changes of attitude and annoyance are associated with characteristics of the exposed individuals. Experience from earlier Swedish and foreign studies of annoyance indicates that interindividual differences in frequency of annoyed persons are explicable only to a small extent by differences in demographic background factors. The variables of sex, age and social class have been shown to have some influence on the experience of annoyance. Thus women tend to be bothered rather more than men, and the old more than the young. The lower social classes, furthermore, show a rather higher frequency of bothered persons than other classes. This difference in frequency is, however, small and the tendencies are not clear-cut (Jonsson 1964).

These results are based on annoyance studies made in areas with special exposure conditions, so that nothing can be said about the reason for differences in frequency of bother between different groups of individuals. But it is not out of the question that they are due to differences in the exposure situation. It is conceivable, for instance, that women are at home during daytime to a greater extent than men and are therefore to a greater extent exposed. The differences may also result from psychological differences between the groups. Thus, if the tendency to a greater propensity for annoyance in women is due to the fact that, to a higher degree than in men, the reaction is built up of psychological factors, the possibility of change should be greater in this group.

In the following account an illustration will be given, on the basis both of the laboratory experiments that have been made and of the earlier reported field experiments in Linköping (see section 3.2), of the problem of the conditions under which a change of attitude and annoyance can be brought about.

4.1. FACTORS WHICH AFFECT THE POSSIBILITY OF CHANGE OF ATTITUDE TO THE SOURCE OF ANNOYANCE AND THE ANNOYANCE REACTIONS. THE NOISE LEVEL

Of the various characteristics of a stimulus which may be of relevance for the possibility of change of attitude and annoyance structures, it was stated that the intensity of noise should be of fundamental significance. This problem may be summarized in the following hypothesis:

Within the area where the noise is clearly perceptible a change of attitude results in a smaller change of annoyance at a high than at a low noise level.

In this section an account will be given of a laboratory experiment intended to illustrate this problem.

4.1.1. Arrangement and conduct of the experiment

A total of 238 subjects (students at Stockholm University in the spring term 1966) took part in the experiment. They were divided into two groups —an experimental and a control group. The arrangement of the experiment will be seen from the table below.

Control group		Experimental group	
Measurement of attitude		Measurement of attitude	
	60 dB(A)		60 dB(A)
Noise exposure	70 „	Noise exposure	70 „
Measurement of	80 „	Measurement of	80 „
annoyance	90 „	annoyance	90 „
	95 „		95 „
—		Influence of attitude	
Measurement of attitude		Measurement of attitude	
	60 dB(A)		60 dB(A)
Noise exposure	70 „	Noise exposure	70 „
Measurement of	80 „	Measurement of	80 „
annoyance	90 „	annoyance	90 „
	95 „		95 „

4.1.2. Influence on attitude

The attitudes in the experimental group were created through the use of a questionnaire containing leading and tendentious questions, a positive introduction to these questions, and a positive account of the results of the group's answers to the questions. An example of the questionnaire is given in appendix 1. The control group was subjected to no propaganda.

4.1.3. Exposure to noise

The subjects were exposed to aircraft noise from a tape recorder connected to loudspeakers which gave a realistic sound reproduction. The sound levels were fixed on the basis of experience from preparatory experiments at 60, 70, 80, 90 and 95 dB(A). Every subject thus listened to noise recordings at five levels. After every exposure the subjects stated the degree of detrimental effect of the noise. After the influence on attitude had been brought to bear, the procedure was repeated once again.

4.1.4. Measurement of response

The measurement of response was intended both to study whether the influence had had any effect on attitudes and to chart the experience of annoyance.

Attitudes were studied on two, earlier tested, equivalent scales of Likert type (Appendix 4). Of these two scales one was used to study the attitudes before and the other after an influence had been brought to bear. On each scale the subjects could obtain points varying between 12 and 60. The points were divided by 12 (number of statements) and the final points for each subject thus varied between 1 and 5. The change of attitude was then calculated by subtracting the first value from the second. The attitude value may thus vary between 0 and 4. It was found in the experiment that a few values were negative, but never less than –0.5. The attitude points were thereafter classified in three categories, –0.5, to 0.4, 0.5 to 1.0, and 1.1 to 1.6 (1.6 being the largest change of attitude measured). The first category is represented in the tables below by 0, the second by 1, and the third by 2.

Owing to the risk that on the second occasion the subjects might remember the assessment of the degree of annoyance they had made on the first occasion, use could not be made of the method normally employed for estimating the experience of annoyance by stating whether they are bothered "much", "fairly much", "not much", "not at all". To reduce the

risk of a memory effect, therefore, graphic scales were used with the endpoints "noise not noticeable" and "noise very bothering".

The usability of the graphic scales was tested before the experiment on another group of individuals. These were asked to indicate the degree of detrimental effect they considered an exposure to tape-recorded noise gave rise to by making a mark on a graphic scale with endpoints defined as above. This test was carried out for every subject, both on different occasions and at different sound levels.

The results of the preliminary tests showed that the individual subjects gave corresponding answers on repeated assessment of noise of different levels, i.e. a similar response to each individual noise level on repeated occasions. The standard deviation for the assessment of each subject on the 13 cm long scale was calculated. The median for these standard deviations was 0.64 and the corresponding quartile deviation 0.02.

In the use of the graphic scale in the laboratory experiment the difference in experience of annoyance between the two occasions was calculated for every subject, i.e. before and after the influencing of attitude. This was done for each of the five noise levels. The differences were then classified in three groups, group 0 consisting of those exhibiting a small or no change of annoyance, group 1 a moderate change and group 2 a great change. By small or no change is meant a difference between the two occasions of less than 1 cm on the 13 cm scale. A moderate change is a difference of between 1 and 3 cm, a great change more than 3 cm. The greatest difference measured was 6 cm.

4.1.5. Results

The results are reported first in respect of the differences in attitude between the two measurements, thereafter in respect of the changed experience of annoyance. The results of the change of attitude will be seen from table 8.

In the control group, which had not been exposed to propaganda, only a small number of individuals (11 %) exhibited changes of attitude. In the group subjected to influence, however, a relatively considerable change of attitude was recorded. Altogether 74 % had changed, rather more than half of whom reported a great change (category 2). The difference between the two groups is significant ($\chi^2 = 84.61$, df $= 2$).

As earlier mentioned, the subjects were exposed to the same noise at five levels, both before and after influencing of attitude.

Table 8

Change of attitude in control and experimental group

		Control group		Experimental group	
		n	%	n	%
Change of attitude	0	70	89	41	26
	1	7	9	56	35
	2	2	2	62	39
	Total	79	100	159	100

Table 9

Change of annoyance for five noise levels in the control group

Change of annoyance	60 dB(A)		70 dB(A)		80 dB(A)		90 dB(A)		95 dB(A)	
	n	%	n	%	n	%	n	%	n	%
0	74	94	79	100	75	95	74	94	74	94
1	4	5	0	0	3	4	3	4	2	2
2	1	1	0	0	1	1	2	2	3	4
Total	79	100	79	100	79	100	79	100	79	100

Table 10

Change af annoyance for five noise levels in the experimental group

Change of annoyance	60dB(A)		70 dB(A)		80 dB(A)		90 dB(A)		95 dB(A)	
	n	%	n	%	n	%	n	%	n	%
0	48	30	54	34	66	41	69	43	88	55
1	57	36	61	38	52	33	59	37	60	38
2	54	34	44	28	41	26	31	20	11	7
Total	159	100	159	100	159	100	159	100	159	100

The change of annoyance between the two occasions in the two groups will be seen from tables 9 and 10.

From the control group results (table 9) it will be seen that those not subjected to influence report changes of annoyance to a very small extent. At the noise levels of 60, 80, 90 and 95 dB(A) about 5 % reported a change, but at 70 dB(A) none a change of annoyance. From table 10 it will be seen that comparatively large changes have taken place in the experimental group. At the noise level of 60 dB(A) 70 % of the subjects

reported a changed experience of annoyance. The percentage change of annoyance thereafter falls with increasing noise level and at 95 dB(A) is 45 %. At 60 dB(A) 34 % reported a considerable change of annoyance, at 95 dB(A) 7 %. Finally it will be seen that the group with moderate change is relatively constant.

The hypothesis that the change of annoyance consequent on influencing of attitude is less at high than at low noise levels is thus confirmed.

4.1.6. Comments

The results of the investigation support the hypothesis that the more specific the experience of a stimulus is, the less possibility there is to reduce the experience of annoyance through a change of attitude. Thus the greatest change of annoyance was found at the lowest noise level, 60 dB(A), and then fell with increasing noise level. The group with moderate change of attitude, however, proves to be relatively constant. This should be a consequence of a stepwise shift between the categories. Thus the subjects in category 2 shift to category 1 on raising of the noise level, while those in category 1 shift to 0. On further increase of the noise level—owing to deterioration of the sound reproduction it was impossible to raise the level above 95 dB(A)—category 1 would presumably have diminished.

As the experiment was carried out in a laboratory environment and not in the field—where admittedly the noise levels may be similar but the intensity of takeoffs, flight times etc. vary—it is difficult to try to determine the limit at which influence on attitude has been entirely eliminated on the basis of the experiment. But it may be pointed out in this connexion that in the earlier reported field experiments at Linköping (chapter 3) noise levels of about 90 dB(A) were measured. Despite these high levels it was possible in the field greatly to lower the frequency of annoyed persons.

A study was made in this experiment of the significance of noise level for the possibility of change of the experience of annoyance, but in practice other noise characteristics would also affect this possibility. The effect of frequency of the noise, length of exposure and time of exposure is presumably such that the possibility of change diminishes at a noise of higher frequency, with longer exposure, and if the noise occurs at a time when activities of importance for the respondents are to be carried out, e.g. in the evening at the time of going to sleep. In the case of an intermittent noise, furthermore, and of a noise which quickly attains maximal level, the possibility of reducing the annoyance reactions would diminish.

4.2. FACTORS WHICH AFFECT THE POSSIBILITY OF CHANGE OF ATTITUDE TO THE SOURCE OF ANNOYANCE AND THE ANNOYANCE REACTIONS. INDIVIDUAL ATTITUDE CHARACTERISTICS

On the basis of the assumptions made above concerning the possibility of change of attitude for different attitude characteristics of the exposed individuals, the following hypotheses may be set up:

1. The frequency of annoyed persons is lower in the groups which consider an airfield important than in those which do not.
2. The possibility of reducing the frequency of annoyed persons through a positive change of attitude is greatest if the exposed individuals have a neutral attitude to the source of annoyance and least if they have a negative attitude.

In the sequel the results will be presented of two laboratory experiments intended to illustrate these problems.

4.2.1. Arrangement and conduct of the experiments

In the laboratory experiment aimed at illustrating the significance of the respondents' opinion on the importance of the airfield a total of 160 subjects took part, divided into a control and two experimental groups. All groups were given a brief description of the exposure situation, and the experimental groups were informed of the significance of the airfield's siting in this particular location.

After this information the subjects were exposed groupwise to aircraft noise and then assessed its degree of bothering effect. The arrangement of the experiment will be seen from the table below.

Control group	Experimental group I	Experimental group II
—	Positive information concerning importance of airfield	Negative information concerning importance of airfield
Exposure to noise	Exposure to noise	Exposure to noise
Measurement of annoyance	Measurement of annoyance	Measurement of annoyance

In this laboratory experiment, which was carried out in 1969, the subjects consisted of students at Stockholm University.

The effect of the original attitude on the possibility of change of attitude and experience of annoyance—hypothesis 2—may be illustrated on the basis of the earlier reported experiment concerning the effect of noise level on the possibility of change. In this experiment a study was made of attitude and annoyance structure before and after the influencing of attitude. The arrangement of the experiment, effect on attitude and measurement of annoyance are reported in section 4.1.

4.2.2. Influence on attitude

In the experiment intended to study the dependence of the annoyance reactions on the attitude of the subjects to the importance of the airfield to society, the information was given to the three groups as follows.

Neutral basic information (all groups)

The aircraft noise was said to be recorded in a residential area in the vicinity of the airfield, the area lying in the direction of take-off. There were about 50 take-offs every day.

Positive information (Experimental group I)

It was stated that airfield had had a beneficial effect on the development of the town, both through the increasing number of tourists and through the improved communications with other places, one result of which had been that a large manufacturing enterprise had been established in the area, with the added employment that this involved.

Negative information (Experimental group II)

It was stated that the airfield had meant nothing for the development of the town but had merely involved heavy capital expenditure. Nor had communications with other places been improved to the extent predicted, and there had been no new establishment of industry.

4.2.3. Exposure to noise

The noise was tape-recorded and derived from four aircraft taking-off in succession. The noise level—80 dB(A)—was identical in the recordings presented to the various experimental groups. It was said to have been recorded indoors with open window.

4.2.4. Measurement of response

The subjects were asked to try to put themselves in the situation of the exposed population group and to judge the disturbing effect they considered the noise gave. The previous graphic scales (section 4.1.4) were used in this experiment. No measurement of attitude was made on this occasion.

4.2.5. Results

The first of these experiments was intended to illustrate any differences in experience of annoyance depending on whether the individual considered the noise gave. The previous graphic scales (section 4.1.4.) were used in this experiment. No measurement of attitude was made on this occasion.

Table 11
Percentage of persons disturbed in relation to attitude concerning the importance of the airfield

	Control group		Positive influence group		Negative influence group	
	n	%	n	%	n	%
Disturbed	22	41	12	21	31	63
Others	32	59	45	79	18	37
Total	54	100	57	100	49	100

In the control group less than half (41 %) considered the noise bothering, which thus constitutes the expected frequency of bothered persons in the two experimental groups. In the group to which the airfield was represented as being of no significance for the development of the town the frequency of bothered persons was higher than in the control group, amounting to 63 %, but lower (21 %) in the group subjected to positive influence. The differences between the experimental groups and the control group are significant ($\chi^2 = 4.36$ and $\chi^2 = 4.17$, df $= 1$). Thus the attitude of the bothered persons to the importance of the airfield affects the individual's judgment of the bothering effect.

On the basis of the earlier experiment concerning the relation between change of annoyance and noise level (section 4.1.) it is possible to test the hypothesis that individuals who originally had the most negative attitude would undergo the least change in response to a positive influence, while those with a neutral attitude would undergo the greatest change. The results

Table 12
Relation between original attitude and magnitude of change of attitude

Change of attitude	Original attitude					
	Negative		Neutral		Positive	
	n	%	n	%	n	%
0	23	54	5	7	13	28
1	10	23	30	43	16	35
2	10	23	35	50	17	37
Total	43	100	70	100	46	100

of this test will be seen from table 12. A negative attitude is indicated by a value on the attitude scale below 2.5 and a positive attitude by a value above 3.5.

It will be seen from the table that the majority (54 %) of those with a negative attitude could not be influenced by the propaganda method used. Of those with a positive attitude 72 % changed, while 93 % of those with a neutral attitude had acquired a higher value on the attitude scale. The differences in change of annoyance between the various attitude groups are all significant ($\chi^2 = 28.26$, $\chi^2 = 4.87$ and $\chi^2 = 7.90$, respectively, $df = 1$).

The results of the experiment also illustrate the relation between original attitude and change of annoyance. In table 13 are recorded the results of the tests at noise level 80 dB(A). It will be seen that of those with a negative attitude 23 % show a change of annoyance as against 81 % of those with a neutral attitude and 56 % of the positive attitude group.

Table 13
Relation between original attitudes and change of annoyance

Change of annoyance	Original attitude					
	−1		0		+1	
	n	%	n	%	n	%
0	33	77	13	19	20	44
1	8	18	26	37	18	39
2	2	5	31	44	8	17
Total	43	100	70	100	46	100

The differences in change of annoyance between all three attitude groups are significant ($\chi^2 = 34.98$, $\chi^2 = 8.88$ and $\chi^2 = 7.28$, respectively, df = 1).

The results are in close agreement with those from the test of change of attitude (table 12).

The initial expectation in respect of the influence of original attitude on the possibility of change of attitude and annoyance structure has thus been verified.

Finally a study has been made of the individual relation between change of attitude and change of annoyance. As will be seen from table 14, 87 % of those with a great change of attitude have reported changed annoyance, and more than half a great change of annoyance. Of those reporting a moderate change of attitude 86 % reported changed annoyance, not quite half a great change. The difference in frequency of bother in the two attitude groups is not significant ($\chi^2 = 0.39$, df = 2). Of those who underwent no or only a slight change of attitude 22 % report a change of annoyance, but of the latter only two a great change of annoyance.

Table 14
Magnitude of change of annoyance for different changes of attitude

Change of annoyance	Change of attitude					
	0		1		2	
	n	%	n	%	n	%
0	32	78	8	14	8	13
1	7	17	25	45	25	40
2	2	5	23	41	29	47
Total	41	100	56	100	62	100

4.2.6. COMMENTS

The aim of these laboratory experiments was to illustrate the influence of attitude on the experience of annoyance and the possibility of bringing about changes in attitude and annoyance in individuals with different attitudes.

The results indicate that individuals who consider the source of noise of importance for the community say they are less bothered by it than those who consider it of less importance.

The significance of original attitude for the possibility of changing both attitude and experience of annoyance could be demonstrated. The change both of attitude and of annoyance was greatest in the group with the most neutral attitude and least in the negative group. Some caution must, however, be observed in evaluating these results owing to the difficulty of exactly determining the position of the neutral zone on an attitude scale of Likert type. But there is no reason to suppose that the neutral zone as here defined is erroneous.

The results concerning the individual relation between change of attitude and change of annoyance indicate that the magnitude of the change of annoyance is not directly dependent on the magnitude of the change of attitude. Persons undergoing a great change of attitude show roughly the same change of annoyance as those undergoing a smaller change of attitude.

4.3. FACTORS WHICH AFFECT THE POSSIBILITY OF CHANGE OF ATTITUDE TO THE SOURCE OF ANNOYANCE AND THE ANNOYANCE REACTIONS. INDIVIDUAL CHARACTERISTICS OF DEMOGRAPHIC CHARACTER

To study the influence of individual factors on the possibility of change of attitude and annoyance, it would be desirable to carry out a field experiment in which attitude and annoyance structures are studied both before and after an influence on attitude is brought to bear. This has not been possible, but the problem can be illustrated to some extent on the basis of the field experiments made in Linköping (1964 and 1967) by comparing the results of the two, thus gaining a measure of the stability of the attitude and annoyance structures in different categories of individuals. The present study thus relates only to those interviewed on the two occasions. The arrangement and conduct of these experiments has been reported in chapter 3.

The individual characteristics, the influence of which on the possibility of change is to be illustrated, are sex and social group, which in a number of earlier studies have tended to correlate with the experience of annoyance (Jonsson 1964). The influence of age on the possibility of change cannot be studied owing to the composition of the material, with a large proportion—about four-fifths—in the 40—50 age group.

4.3.1. Measurement of response

The disturbance variable has been dichotomized—"disturbed", "undisturbed"—as has also the attitude variable—"positive attitude", "non-positive attitude". To the "positive attitude" group have been assigned individuals who have a mean grade above 3.5 for the nine statements sorted according to Likert's criteria, the most positive response for each item being given the value 5 and the least positive 1.

4.3.2. Results

The results are reported first in respect of net changes in attitude and frequency of annoyed persons between the two investigations, for men and women and for high and low social class, and thereafter in respect of the "instability" of the respective groups, i.e. individual change, irrespective of direction.

Table 15

Percentage of respondents with positive attitude and of annoyed persons in 1964 and 1967 by sex and social class

	Control group						Experimental group					
	Number	Positive attitude (%)			Annoyed (%)			Number	Positive attitude (%)			Annoyed (%)		
		1964	1967	Diff.	1964	1967	Diff.		1964	1967	Diff.	1964	1967	Diff.
Men	40	20	38	+18*	77	90	+ 13	41	39	41	+ 2	58	58	± 0
Women	36	8	14	+ 6	83	89	+ 6	33	35	33	—12	52	73	+21
High social class	45	13	33	+20*	80	87	+ 7	49	43	31	+12*	59	65	+ 6
Low social class	31	16	16	± 0	81	94	+13	25	40	52	+12	48	64	+16
Total	76	14	26	+12*	80	89	+ 9*	74	42	38	— 4	55	65	+10

* Denotes significant difference

Table 16

Frequency of "unstable" respondents within the experimental and control groups, by sex and social class

	Control group					Experimental group					Difference experimental-control group	
	Number	Changed attitude		Changed annoyance		Number	Changed attitude		Changed annoyance		Attitude	Annoyance
		%	Diff.	%	Diff.		%	Diff.	%	Diff.		
Men	40	28	+17	18	+1	41	17		24		—11	+ 6
Women	36	11		17		33	24	+7	52	+28*	+13	+35*
High social class	45	24	+11	16		49	12		27		—12	+11
Low social class	31	13		19	+3	25	36	+24*	56	+29*	+23	+37*
Total	76	20		17		74	20		36		± 0	+19

* Denotes significant difference

The frequency of respondents with a positive attitude and of annoyed persons on the two occasions, by sex and social group, is shown in table 15.

It will be seen from the table that in the control group an increase in the frequency of positives occurred from 1964 to 1967. The increase is significant for men and for the higher social group. The experimental group shows a small—for the high social group significant—reduction in frequency of positives.

The frequency of annoyed persons has increased significantly in the control group. This increase—which is not associated with any special category—was to be expected in view of the increasing noise level in the area. In the experimental group there is no statistically significant increase in the frequency of annoyed persons.

The frequency of "unstable", i.e. those who have changed attitude or annoyance status between the two investigations, irrespective of direction, is shown in table 16.

In the control group the instability is not significantly greater in any category either in respect of attitude variable or annoyance variable. In the experimental group women are significantly more unstable than men as regards the experience of annoyance, and the lower social class as regards both the attitude variable and the annoyance variable. A significant difference in instability for women and the lower social class exists also between the experimental and control groups in respect of the experience of annoyance.

The higher instability throughout for women and the lower social class might be a result of an association between these two variables. From table 17 it will be seen, however, that a relation of this kind cannot be demonstmonstrated either for the experimental ($\chi^2 = 0.45$, df = 1) or for the control group ($\chi^2 = 0.15$, df = 1).

Table 17
Relation between sex and social class

	Experimental group		Control group	
	Men	Women	Men	Women
High social class	29	20	25	20
Low social class	12	13	15	16
Total	41	33	40	36

4.3.3. COMMENTS

The results of the analysis indicate that a general increase in frequency of positives has taken place between the two investigations and that this increase relates particularly to men and the higher social classes. No corresponding increase in frequency of positives took place in the experimental group, which may be due to the fact that their attitude has been influenced to so great an extent as to leave no further scope for increase.

Studies of "instability" show that, in the control group, it is not associated with any special category, but in the experimental group is associated with women and the lower social class. This difference in instability indicates that women and lower social classes are easier to change but more readily return to their original attitude, i.e. if a change occurs in men and the higher social class there is a greater tendency to resistance to return to the original attitude.

For full illustration of this problem a field experiment would have been desirable in which attitude and experience of annoyance were studied before and after the influence was brought to bear. The results of the present analysis must therefore be interpreted with some caution. Whether the tendency to differences in changes is due to physical and mental differences of the exposed individuals or to differences in exposure conditions cannot be stated on the basis of this material, but studies aimed at illustrating this question would be desirable.

Other background variables as well of a demographic nature, e.g. age and education, may be relevant for the possibility of change, as also combinations of factors. This has, however, not been possible to study on the basis of the present experiments.

CHAPTER 5

DISCUSSION

The aim of the experiments that have been made has been to illustrate the relation between the attitudes to a source of annoyance and the annoyance experienced. In a laboratory experiment it could be demonstrated that a change of attitude to the source of annoyance in a negative direction resulted in an increase, and in a positive direction a decrease, in the frequency of annoyed persons. Similar results were obtained in a field experiment, in which it was also found that the differences between the influenced and the uninfluenced still remained after three years. The two experiments differ in principle in that, in the laboratory experiment, an attempt was made to create both negative and positive attitudes within groups of individuals whose earlier or present annoyance structure had not been studied, while in the field experiment the majority of subjects must be considered to constitute a group with great experience of the exposure and who probably, therefore, have also a clearly developed attitude structure in respect of its source. Thus, while laboratory experiment illustrates primarily the possibility af creating certain attitudes, which are thereafter manifested in certain reactions, the field experiment shows the significance of influencing of attitude for changing already manifested experiences.

The problem of the conditions under which changes of attitude, with consequent changes of annoyance, are possible to bring about has been illustrated through a number of laboratory experiments. Thus stimulus characteristics, attitude characteristics and individual characteristics have been studied on the basis of the possibility of change. It was found that the possibility of change of attitude structure and annoyance structure increases with lower stimulus level and decreases with higher. It was not, however, possible to determine the limit at which the influencing of attitude was entirely eliminated, one reason being that these experiments were carried out in a laboratory environment in which other stimulus characteristics, e.g. intensity of aircraft movements and time of ocurrence of noise, could not be varied.

The laboratory experiments, aimed at studying the influence of attitude on the experience of annoyance and the possibility of change, show that individuals who experience the source of noise important for the community are less bothered by the noise than others. The possibility of change

also proves to be greatest if the original attitude is relatively neutral and smallest if it is negative.

The individual charcteristics studied from the point of view of possibility of change indicate that the possibility of change is greater in women than in men and greater in lower social classes than in higher, but also that these individuals more quickly return to their original position on the attitude and annoyance scale.

The results of the investigations will be evaluated from the aspect of their reliability and generalizability. The reliability problem is regarded mainly as a representativity problem, as regards both the representativity of the verbal expressions of reaction to a source of annoyance and the representativity of the general material investigated for the population about which information is desired. The possibility of generalizing the results is discussed from the point of view of the special exposure conditions and the special type of influence used in the various investigations.

It has been stated earlier in this report that studies of annoyance yield only subjective data concerning the annoyance reactions, so that one knows no more than the fact that a person who states he is bothered by an exposure has a subjective experience of discomfort. Furthermore the actual and medically relevant meaning of the term "annoyance" has not yet been fully elucidated. It is important to bear this in mind when evaluating the results of a study. The strenght of the relation between attitude to the source of annoyance and the annoyance reactions is presumably different in cases when other reaction data, such as disease symptoms, disturbance of activities etc., are taken into consideration. This is also fully in conformity with the response model set up, which states that the possibility of change should be greater the smaller the influence of disturbances of activity and of physical disturbances on the total response structure.

The primary interest has been associated with changes of the annoyance reaction, but in most of the experiments the attitudes and changes of attitude have also been studied. For these studies attitude scales of Likert type have been constructed. Whether or not these attitude scales present an exact picture of the attitude structure in the groups studied is difficult to say. But classifications have been made in three attitude groups—negative, neutral and positive—and there is nothing to suggest that this classification is inappropriate.

In the laboratory experiments the material consisted throughout of students at Stockholm University and, in the field experiment, of a severely

exposed population group which presumably had well developed attitudes to aircraft and aircraft noise before the experiments were made. None of these groups can be considered to constitute a "normal population". In the laboratory experiments the subjects constitute a clearly defined group which, in contradistinction to the subjects in the field experiment, scarcely had strongly developed attitudes. The results of the laboratory experiments, however, were verified in the field experiment, so that there is no reason to suspect that the laboratory experiments, the aim of which was to illustrate the conditions under which a change can be brought about, are invalid.

A limitation of the validity of the results of the field experiments may be, as already noted, the high degree of exposure, so that the problem was of great concern to the respondents and the propaganda material would have a great interest for them.

The stimulus in the experiments consisted throughout of noise. The reasons for this were that the exposure in the experimental situation is facilitated, i.e. noise is easily manipulatable compared with other stimuli, and that most individuals have experience of noise as source of annoyance. This latter fact was established in an earlier survey of the annoyance caused by noise in the community (Jonsson and Sörensen 1967), in which it was found that more than half of those questioned—a representative sample of the entire adult population—were bothered by one or more sources of noise. Whether the results can be generalized to other sources of annoyance than noise cannot be stated with certainty, but, in view of the relation between attitude to source of annoyance and annoyance reaction demonstrated in studies of the disturbing effect of, for example, air pollution (Cederlöf, Jonsson and Kaij 1964), it is probable that the results are valid also for these stimuli.

As the method used for creating a specific attitude and for influencing already formed attitudes was not particularly provocative, the results from the qualitative aspect should be generalizable. The verification of the hypothesis, however, does not exclude the possibility of a causality in the other direction. It is probable that the experience of annoyance may create an, or reinforce an already formed, attitude.

The magnitude of the effect can, however, not be estimated from the experiments that have been made. As regards the laboratory experiment, a gradient of the strength of the influence could admittedly have been constructed. But this would hardly form a basis for valid generalizations,

for—as noted—the subjects do not constitute a representative sample of an exposed "average population". The results of the field experiments also indicate that the magnitude of the change of annoyance is not directly correlated to the magnitude of the change of attitude. Furthermore the magnitude of the effect is dependent on physical characteristics of the stimulus. Nor can it be stated whether changes in the experimental method, e.g. combinations of special exposure stimuli and information stimuli, would quantitatively affect the results.

The experiments have not had the object to illustrate the problem as to which part of the information given to the respondents—e.g. the view of those responsible for the exposure conditions on the problems of the persons exposed, information concerning factual conditions, etc.—had the greatest significance for the change of attitudes. It is possible that information solely concerning the occurrence and nature of the exposure can produce the same effect as the influencing of attitude that was adopted.

Analyses of how the propaganda instrument should be designed to achieve a maximal effect on the annoyance reaction lies outside the scope of this study, but the results of the experiments would seem to provide an urgent incitement to through studies in this respect. They also give an indication of the ease with which attitudes can be formed, even in a negative direction. This emphasizes the damage that can be produced on the population as a whole by opinion-moulders with negative attitudes to a source of annoyance.

Studies of the influence of external environmental factors on the individual are often made with the aim of providing a basis for new norms in respect of permissible and impermissible exposure or for the application of existing norms. Since these norms are based on dose-response relations, it must be possible to eliminate the effect of irrelevant factors in the measurement of response. Studies of the influence of attitude on the response are therefore important and the results reported indicate that, in annoyance studies, the attitude to the source of annoyance must be measured so that the population can be described from the attitude aspect. It must be considered fully established that significant changes in the frequency of bothered persons can be brought about through a change of attitude. That this possibility exists does not mean, on the other hand, that it is desirable. Thus, in cases in which the annoyance reaction in a given situation is conditioned primarily by the exposure conditions and only to a small extent by negative attitudes to the source of annoyance, it is not advisable to attempt to reduce the frequency of annoyed persons by creating positive

attitudes. This should not be done, at all events until we have gone further in charting the implication of the annoyance reactions and their relation to the state of health in general. For, if the bother involves an indication of health-threatening effects of the noise, an early diagnosis of the effects is rendered impossible.

SUMMARY

The aim of this study has been to throw light on the question how individuals exposed to different external environmental factors experience their exposure conditions and how this experience is influenced by the attitude to the environmental factors. Special attention has been paid to the problem of the possibility of change of the annoyance reaction through a change of attitudes, and under what conditions such a change can be effected. The problem is presented in chapter 1, and in chapter 2 it is illustrated on the basis of the results of earlier investigations, in conjunction with which the problem of what constitutes different annoyance reactions is also discussed.

Chapter 3 deals with the possibility of changing annoyance reactions by change of attitude. This has been studied in a laboratory experiment and in a field experiment. The results of the laboratory experiment show that, by changing of the attitude to a source of annoyance, a change can be effected in the experience of annoyance. To provide a general answer to the question of the possibility of bringing about a change of attitudes, and thereby changing the annoyance reactions, a field experiment was made in which the attitudes to a source of annoyance of subjects in an experimental group were subjected to a positive influence, while no influence was brought to bear in a control group. This experiment showed that, in the field, where the subjects are exposed to noise during a lengthy period and have thus formed distinct attitudes to the source of annoyance, it is possible to influence the experience of annoyance. This field experiment was followed up by a renewed study three years later, when it was found that, as a result of the change of attitude, the change of annoyance is not merely of brief duration but persists in the individuals exposed.

Chapter 4 deals with the question of the conditions under which a change of attitude and annoyance can be brought about. An account is given first of a laboratory experiment aimed at studying the possibility of change at different noise levels. The results of this experiment show that the possibility of change is less at high noise levels than at low. In this chapter, too, the significance of individual attitude characteristics for the possibility of change has been illustrated in a laboratory experiment, which shows that the changes are greatest in the group with the most negative attitudes

to the source of annoyance. Results are given, finally, which indicate that individual characteristics of a demographic nature may be of significance in attempts to change the structure of attitudes and annoyance. Women and the lower social classes tend to be more susceptible to change and to return more readily to their original attitude.

In chapter 5, finally, the results are discussed primarily from the aspect of their reliability and possibility of generalization.

APPENDIX 1

1. One of the most famous exploits of all times was the first solo flight across the Atlantic. Who made this flight?

Alcock-Brown ..... ☐
Cederskjöld ..... ☐
Lindbergh ..... ☐

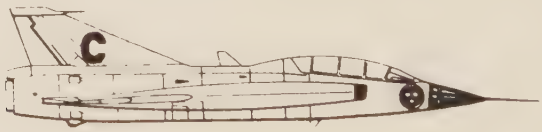
2. During the second world war aviation was of the utmost importance for the outcome of the war. In conjunction therewith a famous man once said: "Never have so many owed so much to so few". Who pronounced these famous words?

Eisenhower on the American pilots ..... ☐
Stalin on the Russian pilots ..... ☐
Churchill on the British pilots ..... ☐

3. That aviation has had a highly significant upswing in recent years is a well-known fact. In 1960/61 SAS carried 1,953,000 passengers. How many do you think flew with SAS in 1962/63?

less than 1.9 million passengers ..... ☐
1.9—2.1 million passengers ..... ☐
more than 2.1 million passengers ..... ☐

4. This is one the most modern fighter aircraft in the world. It was built by SAAB, Linköping. What is the Air Force designation for this aircraft?



5. Two other highly estimated fighter aircraft, also built by SAAB, are "Flygande tunnan" and "Lansen". What are the Air Force designations for these aircraft?

"Flygande tunnan"		"Lansen"	
J29	☐	S32	☐
A29	☐	J32	☐
B29	☐	M32	☐

6. Aviation brings money to a country in many ways. One is through the transport of tourists from abroad. How many passengers do you think travelled by air to Sweden in 1963?

about 100,000 ..... ☐
about 400,000 ..... ☐
about 800,000 ..... ☐

7. In isolated areas it is often very difficult for sick persons to come quickly to a doctor. The great significance of the air ambulance service is therefore easily understandable. How many sick people do you think were transported by air to a doctor in 1963?

100—200 ..... ☐
200—400 ..... ☐
400—600 ..... ☐

8. Aviation has many fields of use. One of them is the distribution of daily newspapers. How many aircraft leave Stockholm every day carrying newspapers?

2 ..... ☐
5 ..... ☐
7 ..... ☐

9. That aviation has developed is beyond dispute. Its development can be measured in many different ways. One is to compare the number of hours of flight in different years. In 1945 some 29,000 hours were flown within Swedish civil aviation, in 1952 the figure was 81,000 hours. How many hours were flown within civil aviation in 1962?

about 120,000 hours .. ☐
about 180,000 hours .. ☐
about 220,000 hours .. ☐

10. Some people are afraid of flying, to a large extent probably because air accidents attract more attention than other traffic accidents. Actually the risks are not so great. During 1962 no fatal accident at all occurred within the whole of Swedish civil aviation. A few mishaps did occur, however. How many PASSENGERS do you think were injured within Swedish commercial aviation during 1962?

less than 5 ..... ☐
5—10 ..... ☐
more than 10 ..... ☐

11. Linköping may be said to be the capital of the Swedish Air Force. Within the Air Force there is an even greater desire to emphasize the situation occupied by Linköping within Swedish military aviation by inducing the authorities to locate a museum of aviation in Linköping, where the treasures of the Air Force can be exhibited. Do you think that this museum, which in such case would be unique in Sweden, would have any propaganda value for the town?

Yes ..... ☐
No ..... ☐

12. Do you think that a civil airport should be built at Linköping?

Yes ..... ☐
No ..... ☐

13. Do you think that the domestic air services should be extended so that, through greater turnover, prices could be lowered?

Yes ..... ☐
No ..... ☐

14. Do you think that the training received by Swedish pilots complies with the high requirements that must be placed on them?

Yes ..... ☐
No ..... ☐

15. Do you think that foreign military aircraft in general have the same high technical standard as corresponding Swedish-built aircraft?

Yes ..... ☐
No ..... ☐

16. Do you think that the obvious advantages of aviation outweigh any disturbance to which an urban population may be subjected by an airfield?

Yes ..... ☐
No ..... ☐

17. Do you consider that aircraft noise, which lasts for quite a short time, is more disturbing than the noise from, for example, a building site which goes on all day long?

Yes ..... ☐
No ..... ☐

APPENDIX 2

Extract from questionnaire.
Direct questions relating to annoyance.

30		Some people have complained of the aircraft noise in the area. Are you bothered by it?
	1	Yes
	2	No
	3	Don't know
31		How much are you bothered?
	1	Much
	2	Fairly much
	3	Not much
	4	Don't know, doubtful
32		How often are you bothered?
	1	Daily
	2	Once or twice a week
	3	More seldom
	4	Don't know, doubtful
38		Are you ever woken by the aircraft noise?
	1	Yes
	2	No
	3	Don't know
39		How often are you woken?
	1	Several times a week
	2	Once or twice a week
	3	Once or twice a month
	4	More seldom

APPENDIX 3

Measurement of Response

Measurement of the experience of annoyance consequent on an external environmental factor is usually based on the subjective annoyance reported by the respondents. There is no other method today of studying these annoyances, which by definition need not imply that the exposure gives rise to physical disturbance or disturbance of activity.

It is probable that in estimating the intensity of annoyance most respondents, consciously or unconsiously, take into account how often the bother occurs. Different studies, however, show that some individuals despite a high intensity of disturbance, are bothered more seldom than those who report a lower intensity of disturbance. A re-evaluation should therefore be made of the total experience of bother in the individuals who report a high intensity of bother but low frequency, and vice versa. This does not imply that the total bother picture is changed but merely that a higher precision is achieved for the description of individual response. Such a re-evaluation of certain individuals' experience of bother concerns only a small number of persons.

An attempt to compose such a measure of response and to test its relevance has been made on the basis of the 1968 traffic noise survey (The National Swedish Institute for Building Research 1970). All possible combinations of occurrence, intensity and frequency of disturbance were formed for this purpose.

Each combination was given a number of points based on the intensity and frequency values. Those who did not notice the noise were given 0 points, those who noticed the noise but were not disturbed by it 1 point, those who were not particurlarly bothered and only a few times a year 2 points, and so on. The various combinations were ranked on the basis of these points. This hypothetical ranking is shown in the table below.

This measure of reaction is assumed to describe the individual's total degree of bother consequent on the exposure, certain individuals being transferred to a category more relevant to their case. Some of the combinations in the hypothetical bother scale may be expected to be infrequent In the 1968 traffic noise survey 644 persons were interviewed. Of this

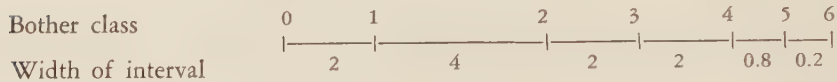
	Class of bother
0	Do not notice noise
1	Notice noise—not bothered
2	Not particularly bothered—a few times a year
3	Fairly much bothered—a few times a year
4	Not particularly bothered—once or twice a month
4	Much bothered—a few times a year
5	Not particularly bothered—once or twice a week
5	Fairly much bothered—once or twice a month
6	Not particularly bothered—once or twice a day
6	Much bothered—once or twice a month
7	Fairly much bothered—once or twice a week
8	Fairly much bothered—once or twice a day
8	Much bothered—once or twice a week
9	Much bothered—once or twice a day

number none came in bother class 2 or 3, only two in class 4, and seventeen in class 5. On this account classes 2, 3, 4 and 5 were lumped together, thus leaving a 7-degree scale.

The reasonability of this hypothetical ranking was tested empirically through a comparison of the various bother classes by 80 subjects pairwise. The results of this comparison in which the subjects stated which of two combinations of answers in their opinion represented the highest degree of bother, show that 76 persons made a comparison in accordance with the hypothetical model. Four could make no distinction between combinations 3, 4 and 5, i.e. the classes later lumped together into one class.

The precision of this scale merely permits ranking of individuals according to degree of annoyance—ordinal scale. To gain a rough idea of the relative magnitudes of the intervals, thus slightly increasing the precision, a separate study was made. The most frequent combination within each of the seven disturbance classes was selected. Forty-seven subjects rated on a 5-degree scale the width of interval between classes 0 and 1 in relation to class 2, then that between classes 1 and 2 in relation to class 3, and so on. The

median for these ratings was calculated, the width of interval between the first two classes was arbitrarily put at two units, and the other intervals could then be determined. The results of these ratings are shown below.



As the difference betwen classes 5 and 6 is only 0.2 unit, these two classes were lumped together and the final scale was therefore as follows.

Index	Class of bother
0	Do not notice the noise
1	Notice the noise/not bothered
2	Not particularly bothered a few times a year—fairly much bothered—once or twice a month
3	Not particularly bothered/once or twice a day Much bothered/once or twice a month
4	Fairly much bothered/once or twice a week
5	Much or fairly bothered—once or twice a week or more often

To test the relevance of this measure of response, data can be used from the 1968 traffic noise survey. This testing of relevance is done by relating the measure of response to various expressions of annoyance. If the measure of response is to be considered relevant, the individuals in the higher annoyance classes should have a higher load of medical symptoms, number of inconvenience factors, spontaneously mention noise to a greater extent, and have taken or planned to take measures to reduce the noise to a greater extent than those in the lower annoyance classes. The results of this testing of relevance are summarized in table 18.

It will be seen from the table distinct relations exist. Of the respondents in the highest annoyance class 60 % report medical symptoms, as against only 1 % in the lowest class. Of those in annoyance class 5 there are 57 % who spontaneously mention noise, as against 2 % in the lowest class. None in the lowest class have taken or planned to take action to reduce the noise, as against 21 % in the highest class. Furthermore the

Table 18

Relation between measure of response and other expressions of annoyance

Class of annoyance	Medical symptoms		Spontaneously mentioned noise		Taken or planned noise-reduction measures		Median of inconvenience factors (disturbance of activities)
	n	%	n	%	n	%	
0	2	1	4	2	1	0	0.0
1	34	14	30	12	10	4	0.3
2	2	11	2	11	1	5	1.2
3	6	17	5	14	5	14	1.9
4	3	17	3	17	2	11	1.8
5	81	60	76	56	28	21	2.9

number of inconvenience factors consequent on the noise increases sharply with increasing degree of annoyance.

To sum up, it may be said that the scale shows good agreement with other variables which constitute an expression of annoyance. There is much to indicate that, already in the rating of intensity and frequency, the respondent has taken these other concepts into account, for which reason it would seem that different expressions of response can be advantage—ously described and qualitatively evaluated by means of the scale.

Another methodological problem that has attracted attention and been studied in conjunction with the measurement of annoyance reaction is the use of different descriptions of reactions in the formulation of the questions.

This problem was partially illustrated in a study in 1963 (Jonsson 1964) of the comparability of different formulations of questions. More specifically, the aim was to study whether a verbal coupling existed between different noises and air pollution stimuli, on the one hand, and different descriptions of the reactions of the exposed persons on the other. The descriptions studied were "unpleasant", "painful", "bothering", "irritating" and "annoying".

The results of this study showed that different descriptions of reactions differ in their adequacy for different types of stimuli. For noise stimuli the expressions "bothering" and "irritating" prove to have been the

commonest descriptions. "Unpleasant" was the description mainly used for bad smell. Dust and soot were associated with the description "unpleasant" and to some extent "annoying".

A separate study was made of the degree of detrimental effect implied in the various descriptions of reaction. Five groups were selected for investigation—altogether 207 individuals—and exposed to seven different noises. These noises derived from motor cycles (heavy motor cycle, scooter and autocycle), truck, passenger car, bus and aeroplane. The subjects were asked what detrimental effect the noise gave rise to. The questions were, however, somewhat differently formulated in the five groups, the respondents in one group stating whether they found the noise irritating, in another bothering, etc. The descriptions of reaction used were identical to those in the aforementioned experiment. The results are presented in table 19.

Table 19

The frequency of subjects who report a detrimental effect of exposure to different motor vehicle noises, with breakdown by the various descriptions of the reaction.

Description of reaction	Auto-cycle %	Truck %	Scooter %	Heavy MC %	Passenger car %	Bus %	Aero-plane %
Unpleasant	88	56	93	86	35	88	93
Bothering	92	75	100	92	62	71	96
Irritating	93	60	100	100	45	83	88
Annoying	70	37	83	83	29	70	87
Painful	61	18	75	57	11	50	68
Noise level: dB(A)	77	68	83	82	64	89	85

As will be seen from the table the frequency of negative reactions differs for the various descriptions. For all stimuli the smallest number of negative reactions is recorded for the descriptions "painful" and "annoying". The highest frequency of negative responses, expressed as "unpleasant", is recorded only at the highest noise level [89 dB(A)], while at other noise levels the descriptions "bothering" and "irritating" have the highest frequencies.

This study thus shows clearly the significance of the description of the reaction for the recorded response.

The effect of not using the most adequate description of reaction is difficult to state, as it is not known whether in a given situation the respondent gives the description the same meaning as the adequate description. As regards the degree of detrimental effect implied by different descriptions of reaction, the differences must be considered significant, especially perhaps for comparisons between different results of investigations.

APPENDIX 4

Scale 1

1. Swedish pilot officers are relatively poorly trained.
2. I try to avoid passing military airfields.
3. I willingly pay twice as much to travel by air as by train.
4. One can take it easy during a flight.
5. I am interested in articles on aviation.
6. I go to military air shows as often as I can.
7. We should try to get rid of military aviation.
8. The Air Force safety regulations are satisfactory.
9. I think it is frightful when a jet aircraft flies at low altitude.
10. I like to read a military aviation journal when I get hold of one.
11. I should never apply for a job in the Air Force.
12. The Swedish Air Force actually implies an infringement of neutrality.

Scale 2

1. For distances of more than 400 kilometres I prefer to fly.
2. The Swedish safety regulations for the training of pilots are fully adequate.
3. I enjoy military air shows.
4. The Air Force pilot is exposed to unnecessarily great risks.
5. I should like a flight in a modern fighter aircraft.
6. I am in favour of increasing the grants to the Air Force.
7. I go to see aviation films as often as possible.
8. The Air Force has an ever growing significance for our defence.
9. I shouldn't like any of my close relatives to be an Air Force pilot.
10. Swedish aircraft meet all demands of safety.
11. Aviation increases the stress of modern life.
12. A well developed aviation network is necessary for the industry of a country.

ACKNOWLEDGEMENTS

The present work is mainly based on epidemiological research that was carried out during 1964 – 1969 at the Institute of Hygiene, Karolinska Institutet and the Department of Environmental Hygiene, National Institute of Public Health, Stockholm. The head of these institutions, Professor Lars Ederberg, M.D., has during all these years shown a never failing engagement in my work and has also most generously made the resources of his institutions available to me.

My teacher in sociology, Professor Gunnar Boalt, F.D., head of the Department of Sociology at the University of Stockholm, has not only demonstrated a great personal interest in the sociological aspects of epidemiology but has also in every way facilitated the progress of my work.

Docent Erland Jonsson, F.D., has during the seven years of data collection and analysis been a most inspiring teacher in sociological methodology, and at last suggested that my own contributions were worth publishing.

Mr Ola Arvidsson, F.K., has contributed much to the discussions concerning the specific epidemiological methodology and Mr John Hogg has devoted much of his time to a careful translation.

Finally I wish to express my thanks to critical colleagues and loyal assistants.

The applied epidemiological investigations have been supported by grants from the Bank of Sweden Tercentenary Fund, and the Research Council of Folksam.

REFERENCES

BERLIN, M., E. JONSSON and A. KAJLAND. Undersökningar rörande expositioner av flygbuller i vissa delar av Linköping, *Report from the National Institute of Public Health, Dept. of Environm. Hygiene*, Stockholm, 1964. (Unpublished).

BORSKY, P. N., Community aspects of aircraft annoyance, *National Opinion Research Center,* No. 54, University of Chicago, 1954.

BORSKY, P. N., Community reactions to air force noise, *National Opinion Research Center,* University of Chicago, 1961.

BORSKY, P. N., *Community reactions to sonic booms in the Oklahoma City area,* AMRL-TR-65-37, AD613620, Wright-Patterson AFB, 1956.

BROWN, J. A. C., *Techniques of persuasion, From propaganda to brain-washing,* Penguin Books Ltd., London, 1963.

CARLSSON, G., *Socialpsykologisk metod,* Svenska Bokförlaget Bonniers, Stockholm, 1954.

CEDERLÖF, R., L. FRIBERG, P. HAMMARFORS, S. E. HOLMQVIST and A. KAJLAND, Studier över ljudnivåer och hygieniska olägenheter av trafikbuller samt förslag till åtgärder, *Nord. Hyg. Tidskr.* 1961, *XLII,* 101—192.

CEDERLÖF, R., L. FRIBERG, E. JONSSON, L. KAIJ and T. LINDVALL. Studies of annoyance connected with offensive smell from a sulphate cellulose factory, *Nord. Hyg. Tidskr.* 1964, *XLV,* 39—48.

CEDERLÖF, R., L. FRIBERG, E. JONSSON and A. KAJLAND, Prognos rörande eventuell sanitär olägenhet till följd av bullerstörningar från ett skjutfält. *Report from the National Institute of Public Health, Dept. of Environm. Hygiene,* Stockholm, 1964. (Unpublished).

CEDERLÖF, R., E. JONSSON and L. KAIJ, Om representativiteten hos opinionsyttringar och opinionsyttrare vid ett hälsovårdsärende, *Report from the National Institute of Public Health, Dept. of Environm. Hygiene,* Stockholm, 1964. (Unpublished).

EDWARDS, A. L., *Techniques of attitude scale construction,* Appleton-Century-Crofts, New York, 1957.

FISCHBEIN, M. (ed.), *Readings in attitude theory and measurement,* John Wiley & Sons, New York, 1967.

GILBERT, G. M., Stereotype persistence and change among college students, *J. Abnorm. Soc. Psychol.* 1951, *45,* 245—254.

HARMON, F. L., The effects of noise upon certain psychological and physiological processes. *Archives of Psychology* 1933, *23,* 5—81.

ISRAEL, J., *Experimentella undersökningar av attitydförändringar,* Stockholm, 1959. (Unpublished).

JERISON, H. J., Performance on a simple vigilance task in noise and quiet. *J. Acoust. Soc. Amer.* 1957, *29,* 1163—1165.

JONSSON, E., Annoyance reactions to external environmental factors in different sociological groups, *Acta Soc.* 1964, *7,* 229—263.

JONSSON, E., On the formulation of questions in medico-hygienic interview investigations, *Acta Soc.* 1964, *7,* 193—202.

JONSSON, E., A. KAJLAND, B. PACCAGNELLA and S. SÖRENSEN, Annoyance reactions to traffic noise in Italy and Sweden, *Arch. Environ. Health* 1969, *19,* 692—699.

JONSSON, E. and S. SÖRENSEN, Förekomst av bullerstörningar i samhället, *Nord. Hyg. Tidskr.* 1967, *XLVII,* 21—34.

KLAPPER, I. T., *The effects of mass communication, Glencoe,* Illinois, 1960.

KRECH, D., R. S. CRUTCHFIELD and E. L. BALLACHEY, *Individual in Society,* McGraw-Hill, New York, 1964.

LAIRD, D. A., The influence of noise on production and fatigue, as related to pitch, sensation level, and steadiness of the noise, *J. Appl. Psychol.* 1963, *47,* 320—330.

LANG, J. and G. JANSEN, Report on the environmental health aspects of noise research and noise control. *WHO Report EURO 2631,* May 1967.

LAZARSFELD, P. F. (ed.), *Mathematical thinking in the social sciences,* Glencoe, Illinois, 1954.

LUKAS, J. S. and K. D. KRYTER, A preliminary study of the awakening and startle effects of simulated sonic booms, *NASA CR-1193,* 1968.

LUKAS, J. S., J. PEELER and K. D. KRYTER, Effects of sonic booms and subsonic jet flyover noise on skeletal muscle tension and a paced tracing task. *Stanford Res. Institute, California,* 1969, *Sept.* 1—38.

MACCOBY, E. E., T. M. NEWCOMB and E. L. HARTLEY, *Readings in social psychology,* Henry Holt & Company, New York, 1958.

McKENNEL, A. C., *Aircraft noise annoyance around London (Heathrow) Airport,* Central Office of Information, London, 1963.

MORRISSETTE J. O., An experimental study of the theory of structural balance, *Hum. Relat.* 1958, *11,* 239—254.

The National Swedish Institute for Building Research and the National Institute of Public Health, Sweden, *Traffic noise in residential areas.* 36E/68, 1970.

NEWCOMB, T. M., R. H. TURNER and P. E. CONVERSE, *Social Psychology. A study of human interaction,* Routledge and Kegan Paul Ltd., London, 1965.

Noise as a public health hazard, *The American Speech and Hearing Association,* ASHA Report No. 4, Wash. D.C., 1969.

NOWAK, K., B. CARLMAN and K.-E. WÄRNERYD, *Masskommunikation och åsiktsförändringar,* Norstedts, Stockholm, 1966.

OSGOOD, C. E., G. J. SUCI and P. H. TANNENBAUM, *The measurement of meaning,* University of Illinois Press, Urbana, 1957.

PROHANSKY, H. and B. SEIDENBERG (ed.), *Basic studies in social psychology,* Holt, Rinehart & Winston, New York, 1966.

ROSENBERG, M. J., Cognitive structure and attitudinal effect, *J. Abnorm. Soc. Psychol.* 1956, *53,* 367—372.

SECORD, P. F. and C. W. BACKMAN, *Social Psychology,* McGraw-Hill, New York, 1964.

SHERIF, M. and C. W., *An outline of social psychology,* Harper, New York, 1956.
SOU 1961:25, Flygbuller som samhällsproblem, Stockholm, 1961.
STEINICKE, G., Die Wirkungen von Lärm auf den Schlaf des Menschen, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nordrhein-Westfalen,* No. 416, 1957.
TEICHNER, W. H., E. AREES and R. REILLY, Noise and human performance, a psychophysiological approach, *Ergonomics* 1963, *6,* 83—97.

Tryckeri Balder AB, Stockholm 1970